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STATE OF MONTANA
STATE HIGHWAY COMMISSION



Manual of Instructions Maintenance

SECOND EDITION



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D. A. MCKINNON, *State Highway Engineer*
E. B. DONOHUE, *Maintenance Engineer*

AUGUST, 1935

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**Manual of Instructions
Maintenance**

SECOND EDITION



THURBER'S, HELENA



D. A. MCKINNON, *State Highway Engineer*
E. B. DONOHUE, *Maintenance Engineer*

AUGUST, 1935

August 15th, 1935.

TO THE EMPLOYEES OF THE
STATE HIGHWAY COMMISSION:

This Manual consists of a compilation of instructions and standards of practice to be followed by the Maintenance Department of the Montana Highway Commission.

These instructions and standards are based upon past experience and results but we do not necessarily consider them perfect, nor do we expect or want employees to become automatons, "guided solely by this "Bible".

We do expect every employee to display initiative, especially in unusual emergencies and suggestions on methods contained throughout will be gladly received and fully considered

The design we have chosen for a symbol is based on the Latin words from which the English word "maintenance" is derived, namely, "manus" meaning "hand" and "teneo", "to hold".

The Maintenance department is constantly on the firing line with the traveling public and it is our desire to build up an organization that will have efficiency, intelligence, diplomacy and an esprit-de-corps unequalled by any other state in the Union.

Very truly yours,

D. A. McKINNON
State Highway Engineer

By:

E. B. DONOHUE
Maintenance Engineer

MAINTENANCE DEPARTMENT MANUAL OF INSTRUCTIONS

INTRODUCTION

To the maintenance organization is assigned the care and upkeep of the state highways, to the end that the investment in our roads may be conserved, and that traffic may operate both safely and economically.

The general instructions contained herein are issued to secure uniformity of practice in methods developed by experience, and to impress upon each employee the necessity for sound, economical work and for satisfactory relations with the public for whose benefit our work is prosecuted.

CHAPTER I

ORGANIZATION AND GENERAL DETAILS

1. ORGANIZATION

1.1 Headquarters Office The Maintenance Department comprises that branch of the service to which has been assigned the upkeep and restoration of roads and bridges, the repair and replacement of equipment, and the construction and upkeep of maintenance buildings and shops. The administration is under the direction of the Maintenance Engineer at Headquarters Office, who is the representative of the State Highway Engineer in all matters pertaining thereto.

1.2 Division Offices The State is divided into five divisions, each in charge of a Division Engineer. The Maintenance Engineer, or his Assistant, deals directly with the Division Engineers who are responsible for the work in their respective territories. The Division Engineer is assisted in maintenance matters by Resident Engineers or Maintenance Superintendents, as requirements demand. The highways are divided into territories which vary from 200 to 450 miles and are under the direction of a Resident Engineer or Maintenance Superintendent. Each territory is in turn divided into maintenance sections, the length varying to fit local conditions. Each of these sections is under the direct supervision of a section man or foreman.

1.3 Maintenance Engineer The Maintenance Engineer exercises general supervision over all maintenance activities. He has general supervision over the funds set aside for maintenance and recommends to the State Highway Engineer their allotment as the need arises. He advises and assists the Division Engineers in the handling of their divisions and regarding methods applicable to maintenance.

1.4 Assistant Maintenance Engineer The Assistant Maintenance Engineer is the representative of the Maintenance Engineer in all matters pertaining to departmental duties. He will consult with Division Engineers regarding all matters within this jurisdiction.

1.5 Equipment Superintendent The Equipment Superintendent is in charge of all maintenance equipment, stores, and supplies. He will, under the direction of the Maintenance Engineer, make periodic field inspections of all maintenance equipment and shop facilities. He will consult with the Division Engineers regarding all field equipment, shops, etc.

1.6 Assistant Bituminous Engineer The Assistant Bituminous Engineer is the representative of the Maintenance Engineer in the construction and maintenance of oiled roads by State-operated crews. The Assistant Bituminous Engineer will inspect this work in detail, inform Division employees of methods and practices in other parts of the state, and, under the direction of the Maintenance Engineer, advise the Division Engineers regarding situations which should be corrected.

1.7 Division Engineers The Division Engineer is the representative of the State Highway Engineer, and has charge of and is responsible for all roads within his district, including their maintenance.

1.8 Resident Engineers and Maintenance Superintendents The Resident Engineer or Maintenance Superintendent in charge of a territory within the Division is a field assistant to the Division Engineer. He will plan and direct the efforts of the foremen and section men within his territory, standardize their methods and equipment according to accepted practice, and is responsible to the Division Engineer for the results obtained. He will be called upon from time to time for estimates, special investigations, and reports on conditions in his territory. The number of Maintenance Superintendents or Resident Engineers will be varied with the amount of work and the size of a territory.

1.9 Foremen and Section Men The maintenance foreman or section man is the keystone of the organization. He is removed from constant supervision of his superiors and must often act on his own initiative. Through his work the public forms its impression of the highway organization, and whether it is favorable or otherwise depends upon his personal conduct and efficiency in the management of his forces and equipment. He and his men shall at

all times be courteous and helpful to the public. He must know his section intimately and guard it from destruction or encroachment. During rains, he should go over his road and note for future corrections all places where drainage may be faulty or structures inadequate. He shall inspect all bridges at frequent intervals, both foundations and superstructure, and report weaknesses to his superiors.

2. GENERAL DETAILS

1.10 Employment As far as possible men shall be employed from the counties in which they reside. Employees assigned to sections shall live midway on their assignments so that equipment will not be traveling to and from work any great distance. Promotions shall, if possible, be given to men already employed. Work in Montana is largely seasonal and Resident Engineers and Maintenance Superintendents shall be governed as follows in the employment, reemployment, lay-off, or release of personnel: Other things being equal, men with dependents shall be given preference; ex-service men with dependents shall be given preference over non-service men; length of service with this Department shall be the second consideration. Available work during slack periods shall be spread as much as possible, using a four or five-day week, or a two-week on and one-week off plan.

1.11 Personnel Cards Standard personnel card shall be prepared by the Resident Engineer, Maintenance Superintendent, or Foreman. Care shall be taken that all names be spelled correctly and no nicknames are used. Whenever a new employee is engaged a card shall be made out in triplicate, one copy retained by the Resident Engineer, the other two being sent to the Division Office for approval, after which one copy is forwarded to Headquarters Office. A personnel card shall not be submitted for a person who has previously worked for the Department, but a written report, showing the employee's present rating and classification and the date he was reemployed, shall immediately be forwarded through the proper channels. In order to keep the records complete at all times, a written report shall also be submitted at once, showing any change in an employee's rate or classification, or his transfer or release, and effective dates. If personnel cards, notices of reemployment, salary changes, etc., are not in the Helena

Office and an employee is shown on the payroll, he will not be paid, or will be paid at the rate shown on the personnel card.

1.12 Upon reaching permanent headquar-
Addresses ters, the employee assigned to take
charge of work shall at once notify the
Division office of his postoffice, telephone and tele-
graphic address.

1.13 A wage schedule for maintenance em-
Wage Scale ployees has been adopted, setting forth
classification, title, and rate of pay.
This schedule shall be rigidly observed and all titles and
rates of pay shown on payrolls must agree with same.

1.14 Maintenance crews shall leave their
Working Hours headquarters in time to be on the job
at 8:00 o'clock each morning, and
shall work on the job eight hours from that time, ex-
clusive of their lunch hour, from 12:00 o'clock to 1:00
o'clock P. M., returning to headquarters on their own
time. Foremen shall work with their crews. In emer-
gencies, hours of work will be as directed by the fore-
man or his superior.

1.15 No attempt is made to regulate the
Responsibility personal habits of employees but every
employee is expected to attend to his
duties in a sober, conscientious and industrious manner.
The employees are representatives of the State High-
way Commission and their actions are to be taken as
indicating the morale of the whole Department. There-
fore, they shall conduct themselves at all times in such
a manner that no reflection can be cast upon themselves
or upon the Department. No loafing, visiting, or gossip-
ing during working hours will be tolerated. No em-
ployee shall work under any person to whom he is
related by consanguinity in the fourth degree and affin-
ity in the second degree. Employees are expected to
pay their current bills promptly, and should it be neces-
sary for a creditor to resort to Headquarters or legal
action for the collection of same, it will be considered
sufficient cause for immediate dismissal.

1.16 All transfers of employees from one
Transfers of district or division to another shall be
Personnel immediately reported to Headquarters
by letter giving full details, and the
person to whom the employee is transferred shall be

notified at once in the same manner, especially stating the last date the employee was carried on the payroll at his previous assignment.

**1.17
Laws**

A pamphlet compiled by John W. Bonner, Attorney for the Highway Commission, is available for distribution to responsible employees. This pamphlet contains the more important statutes relating to roads, highways, bridges, etc. Executive personnel should obtain a copy of this pamphlet and familiarize themselves with such of these laws, statutes, rules and regulations as have a bearing on their particular branch of the work.

Employees may be deputized where especial need exists, but unless especially deputized by a county sheriff or other authorized peace officer, an employee has no police power. In case an employee is deputized, his authority as an officer of the law is to be used only when necessary for the protection of the highway or of its employees.

**1.18
Payroll**

Labor payrolls are to be prepared as of the 15th day of each month by the Resident Engineer or Maintenance Superintendent. Two copies are to be forwarded in time to reach the Division Office by the 17th day of the month, and the Division Office shall check not only the classification, rate and time, but also the distribution code, and send the checked, original payroll so that it will arrive at Headquarters by the 20th day of each month. The distribution of time for each individual on the payroll is to be shown by section prefixes, order, and code numbers. The payroll shall show if the employee is newly employed, reemployed, or released, and the dates effective in each case. When an employee is transferred, the payroll shall show from whom and the date, as well as to whom and the date he was transferred. If an employee's rate is changed, his name and his time should appear two or more times on the payroll, once for each change of rate, showing the dates effective. In all cases, the classifications shown on the payroll shall agree with those shown on the Wage Schedule. All teams shall be carried on the payroll and shown under the owner's name. Should three or more men be released at the same time, prior to the regular payroll date, a payroll on the standard form and marked "Supplementary" shall be prepared by the Resident Engineer or Maintenance Superintendent, and submitted through the regular channels rather than

submitting individual claims. Any employee who has been paid by state claim shall be so listed on the payroll. On all major special maintenance or betterment work, such as oiling, resurfacing, etc., a separate payroll on the regular form shall be prepared by the time-keeper or foreman and submitted through the regular channels. With the exception of division or headquarters mechanics any person or persons assigned to this special work for a period of three or more days shall be carried on this payroll.

1.19 Correspondence Rules to be followed: A letter shall refer to a single subject insofar as practicable. The heading of all letters shall show either section designation and job number, to permit ready reference or filing. Carbon copies of all letters, reports, and records are to be retained and filed by all field men. Letter books shall be used when letters are written in long hand. When letters relative to any part of the work are written to other than the Division Engineer, an extra carbon copy is to be made and forwarded to the Division Office. When a letter is received requesting information which cannot be furnished within a few days, the letter should be acknowledged with a statement as to the probable date the required information can be furnished.

1.20 Telephone and Telegraph Employees shall use long distance telephone or send telegrams only for matters of importance requiring immediate action.

1.21 Freight and Express All equipment repairs and supplies are purchased by the State with the understanding that all carrier charges are to be prepaid by the Consignor. In case a shipment arrives with carrier charges collect, the charges may be taken care of by using state claim form No. 23, as the State has a credit rating with the Railroad Companies. When a claim of this nature is submitted, a copy of the freight or express bill must be attached. Should a local agent of the Railroad or Express Company question the State's credit or right to settle a charge in this manner, request him to wire the auditor of his company for approval.

1.22 Section Men's Weekly Report Standard weekly reports shall be prepared in duplicate by the section man, foreman, or any maintenance employee who has been so requested.

These reports must be prepared at the end of each week and on the 15th of each month. The original report shall be submitted to the Resident Engineer or Maintenance Superintendent and the duplicate retained. These reports must be complete in all details.

**1.23
Traveling
Expenses**

Expense accounts up to the legal amount will be allowed to Headquarters employees, Division and Resident Engineers, and Maintenance Superintendents when away from their Headquarters. Extra gangs such as oiling crews will be allowed an additional \$15.00 per month for monthly men and \$0.06¼ per hour for hourly men. Other employees, such as truck drivers, section men, and foremen, may or may not, at the discretion of the Division Engineer, be allowed expenses up to the legal amount when they are on a special detail or assignment of short duration.

**1.24
Requisitions**

Requisition Form No. 46 shall only be used for requisitioning office supplies, stakes, and other engineering needs. Only one copy of this form shall be submitted to Headquarters Office. Requisition Form No. 76 shall be used for any other supplies, and shall be made in quadruplicate, with three copies submitted to the Division Office for approval. The approved original and duplicate shall be forwarded to Headquarters. After this requisition has been taken care of at Headquarters, the manner of disposal will be noted on the duplicate copy which will then be returned to the Division Office for their information. When ordering replacement parts it is necessary that the equipment number assigned to the equipment for which the order is being made, be given so that part numbers may be checked before the order is placed. Where no equipment number has been assigned to a unit, the part numbers, serial or manufacturer's number and all special catalogue or parts-list reference should be given in detail.

**1.25
Sale of
Materials**

No materials, such as road oil, stock piled materials, etc., shall be sold unless authority has been secured from Headquarters. If permission has been granted and materials have been delivered, send information to Headquarters as to amount delivered, agreed price, to whom bill will be sent, and to which account credit should be given.

1.26 All small tools are to be charged out
Small Tools as they are received. An accurate
and Supplies record will have to be kept of this
 equipment so that an inventory can be
prepared when called for.

Supplies and Equipment Issuance Record: All supplies and equipment shall be fully described as to kind, size, etc. The form should be filled in completely and signed by party receiving same. The original should go to the party receiving; duplicate to Division file, and triplicate retained in the book. An employee is responsible for all supplies and equipment drawn by him until they have been returned.

Supplies and Equipment Returned Record: All supplies and equipment returned shall be checked as to condition and disposition noted, whether condemned or returned to supply room. All supplies or equipment shall be fully described as to kind, size, etc. The form should be filled in completely and signed by party checking same. The original should go to the party making the return; duplicate to Division or District file and triplicate retained in the book. Any equipment broken or lost thru negligence shall be replaced by the party who is at fault.

Release of Property and Unserviceable Small Tools and Supplies: When tools or supplies become unserviceable this form is to be filled in completely and explained in detail. After this form has been sent in these tools or supplies should be dropped from the inventory. original form is to be sent to Headquarters, duplicate to Division Office, and the triplicate retained in the book.

1.27 Before any special units are constructed
Construction in the field, a plan should be submitted
of Special to Headquarters showing all
Maintenance attachments in detail. If these units
Units meet with the approval of the Equipment Superintendent they will either
be made up at the Helena Shop or permission for field
construction will be granted.

1.28 To secure complete accounting and
Miscellaneous history of progress miscellaneous reports
Reports, Etc. and records are to be handled as
 the particular work may require.

1.29
Transfer and Repair of Special Equipment
(Gas, Shovels, Crushers, etc.)

In transferring equipment of this type from one Division to another, all tools, usable parts, new parts, etc., shall be transferred along with the equipment. The equipment should be placed in good condition before transfer. All charges for transfer will be charged to the Division to which equipment is to be transferred. When work has been completed and equipment is transferred to Headquarters for overhauling, the Helena Office will make final distribution of charges for transfer and overhauling.

1.30
Transfer and Repair of Major Equipment
(Motor Patrols, Cats, etc.)

In transferring equipment of this type from one Division to another, all tools, etc., shall be transferred with the equipment. The equipment shall be placed in good condition before transfer. All charges for transfer will be charged to the Division to which the equipment is being transferred.

1.31
Transporting Personal Cars, Bunk Houses, Etc.

Moving of personal cars, bunk houses, etc., behind state equipment is prohibited. Employees must provide their own power or driver whenever personal equipment is being moved.

1.32
Gasoline and Plant Setup

All gasoline will be delivered from Division and District Shops to the field for use on general and special maintenance and betterments, also on construction projects where gasoline can be delivered while enroute.

Close check must be made of all gasoline delivered and that which has been used so that all records will be correct. A want-list should be posted at place of field storage so that driver can pick this up and bring supplies on his next trip, such as small tools, cutting edges, etc. These wants must be anticipated so that no extra trips will be necessary.

1.33
Permit for Excess Size and Weight

The State Highway Commission and local authorities in their respective jurisdictions may in their discretion, upon application in writing and good cause being shown therefor, issue a special permit in writing, authorizing the applicant to operate or move a vehicle of a size or weight exceeding

the maximum specified in Chapter 147 of the Session Laws of 1933 upon any highway under the jurisdiction of and for the maintenance of which the body granting the permit is responsible. No permit shall be issued for more than nine (9) months and every such permit shall designate the routes to be traversed and may contain any other restrictions or conditions deemed necessary by the body granting such permit, and may be cancelled at any time by such body for cause. Every such permit or a true copy thereof shall be carried in the vehicle to which it refers and shall be open to inspection by any peace officer, and it shall be a misdemeanor for any person to violate any of the terms or conditions of such special permit.

Whenever a Resident Engineer or Maintenance Superintendent is asked for a permit, he should get in touch with the Division Engineer, explaining in detail the purpose of the permit. The Division Engineer is authorized to issue a permit upon forms supplied by the Helena Office. If a house is to be moved, arrangements should be made to move during the hours when traffic is the lightest. Every available precaution should be used as to flagmen, lights, etc.

1.34 Load Limits In some instances it may become necessary to set a load limit on sections which are breaking up due to deterioration, rain, snow or other climatic conditions. Restrictions as to the weight of vehicles can be enforced for a total period of not to exceed ninety (90) days in one (1) calendar year.

The Division Engineers should make a careful study of the situation, submitting their recommendations to Headquarters as to gross weight per inch width of tire and gross weight limit. After receiving approval from Headquarters, signs shall be erected and maintained at both ends of the restricted area and at any intersecting roads in the area where necessary. Headquarters must be advised when restrictions are lifted.

1.35 Cutting Timber It is an established policy to permit no cutting of green timber or any other alteration in the natural aspect of the government-owned land on either side of highways within the national forests. This policy is provided in order that such natural beauties as exist along the highways may be preserved. Thus we permit no cutting of green timber on such areas, and in

order that our restrictions may not be abated, we require that any tree with a green branch on it is to be considered as alive.

1.36 Section men should advise Resident
Emergencies Engineers or Maintenance Superintendents whenever an emergency occurs, such as slides, washouts, bridge failures, blockades, etc., which delays or endangers traffic and the possible duration thereof. As soon as the road has been opened for traffic he should again advise. Division Offices should arrange to wire this information into Headquarters as soon as possible after receiving it. On sections that are completely closed during the winter months, Headquarters shall be wired when the section is closed in the fall or winter and when it is opened in the spring.

1.37 (a) **EMPLOYEES.** In case of accident to an employee, State Industrial
Accidents Accident Board Form No. 37 shall be prepared by the employee's immediate superior, and Form No. 37-A by the employee. These forms shall be mailed to the Division Office, which in turn will submit both forms with a letter of transmittal direct to the Industrial Accident Board at Helena, with a copy of the letter of transmittal to Headquarters Office. If the accident is fatal, telegraphic or telephonic report shall be made immediately to the Division Office which in turn will notify Headquarters Office, followed by the usual written reports. An injured employee who has been working by the hour or day shall not be carried on the payroll while incapacitated. In the case of an employee working on a monthly basis a complete report of his case shall be sent through the Division Office to Headquarters Office for decision as to whether or not he should be shown on the payroll. All Division and Resident Engineers and Maintenance Superintendents should have a copy of and familiarize themselves with the "Workmen's Compensation Act".

(b) Report all accidents which may occur in the vicinity of highway equipment.

(c) **ACCIDENT—General and Livestock.** All accidents which come to your attention shall be reported as soon thereafter as possible, with newspaper clippings if available.

(d) **STATE EQUIPMENT.** The State Highway Commission has arranged for property damage and pub-

lic liability insurance covering all motorized equipment and team graders. In case of an accident involving state equipment, report is to be made immediately, in triplicate, by the Resident Engineer or Maintenance Superintendent on the form furnished by the Insurance Company. One copy shall be submitted direct to the Insurance Company, and one each to Headquarters and Division Offices.

(e) **PERSONAL LIABILITY.** In case of personal injury, either to a state employee or a person not a state employee, resulting from an accident involving state equipment, all possible assistance in securing medical treatment shall be given. Under no circumstances, however, shall any responsibility be assumed for the satisfaction of the fees in connection therewith as the State has no legal right or funds to take care of claims of this nature. The hospital or doctor should be given to understand that any treatment or care they may give must be settled either with the injured party, Industrial Accident Board, or the Insurance Company. Employees should not discuss or present facts concerning an accident except with department heads, other authorized officers, or representatives of the Insurance Company. Private cars or trucks shall not be used on state work without prior authorization from Headquarters Office, and even then an employee who uses a privately owned machine does so at his own risk and is liable for recovery in case of accident.

CHAPTER II

FUNDS AND ACCOUNTING

- 2.1 Sources of Funds** (a) **FUNDS.** Funds for the maintenance, repair, widening, resurfacing, and reconstruction of state highways are derived primarily from the Motor Vehicle Fuel Fund or gas tax.
- 2.2 Financial Control** (b) **BUDGET.** The preliminary financing of work is controlled by a system of departmental work orders. The financial requirements of each district are to be submitted to Headquarters Office at such times as, and in the detail requested.
- 2.3 Work Orders** (c) **MAINTENANCE ALLOTMENTS.** From the funds made available by budget, allotments are set up under maintenance work orders. General maintenance allotments are made to the Division for fiscal year periods. Allotments for major slide removals, special maintenance, and betterments are considered individually when requested, and must be authorized by the Maintenance Engineer prior to starting work.
- 2.4 Detail of Work and Estimate** Requests for major slides, special maintenance, or betterment orders should furnish sufficient detail to clearly set forth the work proposed, and justify the cost estimate. Photographs are often of material assistance in considering the request.
- 2.5 Procedure** Standard maintenance estimate forms shall be made out in triplicate by the Resident Engineer or Maintenance Superintendent and shall show the length of each project or part of project (length to be figured in thousandths), whether concrete, oiled, gravel surfaced, unsurfaced, etc. These are then submitted to the Division Office. After approval by the Division Engineer, original and duplicate copies are forwarded so as to reach Headquarters by April 1st for the approval of

the Maintenance Engineer. Upon approval, the duplicate copy is returned to the Division Engineer who can then release the triplicate copy to the Resident Engineer or Superintendent in direct charge of the work.

2.6

**Monthly
Statements**

(a) At the end of each month Resident Engineers or Maintenance Superintendents shall submit a duplicate statement of all Special and Betterment orders under their jurisdiction to the Division Office, which in turn shall forward the original to Headquarters Office so that it will reach this office by the 10th of each month. These reports shall show section prefix, order number, original estimate, approximate amount expended, approximate amount to complete, probable date of completion and the status, whether pending, underway, or completed. If completed, date of completion shall be shown and thereafter no further report is necessary. It is understood that no more field charges will be incurred after this date, except equipment repairs and overhaul.

(b) On all betterment and special maintenance work which involves expenditures of \$10,000.00 or more, a timekeeper shall be employed and a complete record shall be kept as to the cost. A report shall be submitted weekly on regular forms showing total cost for week and total cost to date. Original shall be sent direct to Headquarters and a copy to the Division Engineer.

(c) On all betterment or special maintenance work which involves an expenditure of less than \$10,000.00, a timekeeper will not be required. It will be necessary to keep some kind of record so that the total cost will be kept within the budget, as no overruns will be allowed. A report shall be submitted monthly showing total cost for month and total cost to date. Original shall be sent direct to Headquarters and copy to the Division Engineer.

(d) Statements of betterments and special maintenance expenditures shall be sent to the field by Headquarters showing the status of all special maintenance and betterment orders as of the end of each calendar month.

(e) Maintenance Expenditure Form 50-Revised shall be in Headquarters Office each month and sent to

the Division Office so that all field copies can be brought up to date, after which original reports are returned to Headquarters.

2.7 Expenditures must not exceed work
Overdrafts order allotments. If the funds provided prove insufficient to defray the cost of work undertaken a supplemental request shall be made to cover the anticipated overdraft, prior to its actual occurrence, so that the facts may be known to the Maintenance Engineer. No work shall be carried on without definite authorization.

2.8 (d) MAINTENANCE ACCOUNTING. All charges under the maintenance department, with the exception of construction force account items, must be classified under one of three heads, viz: General maintenance, special maintenance, and betterments.
Accounts and Codes

2.9 General maintenance consists of all maintenance work done by regular forces with stock equipment, and covers blading, dragging, cleaning ditches, removing weeds, etc.
General Maintenance

2.10 Special maintenance consists of purely maintenance work involving a large or unusual expense, requiring increased force and equipment. It consists of resurfacing, adding a large amount of filler, removing large slides, etc.
Special Maintenance

2.11 Betterments consist of any addition to the original construction, or construction of an improved type. It consists of grade raises, line revisions, original oiling, etc.
Betterments

2.12 The section prefix denotes the location of the work. The counties are each numbered alphabetically, and in writing a section prefix the county serial number is used first followed by the letter "M" designating maintenance, and another letter designating the section within the county. For instance 11 MA represents the section in Dawson County between the Wibaux County line and the Prairie County line, and replaces Federal Aid Number 6, 199, 121, 213, 7, and 130.
Section Prefixes

Following are the section prefixes to be used for the various counties in the State:

Beaverhead County

- 1 MA U. S. 91—Silver Bow County Line-Idaho State Line.

Big Horn County

- 2 MA U. S. 87—Yellowstone County Line-Wyoming State Line via Hardin.
2 MI Yellowstone County Line South to Hardin.

Blaine County

- 3 MA U. S. 2—Hill County Line-Phillips County Line.
3 MQ Savoy Creek Bridge (80)

Broadwater County

- 4 MA U. S. 10-Alternate—Lewis and Clark County Line to Junction Butte and Three Forks.
4 MB Townsend-Meagher County Line.

Carbon County

- 5 MA U. S. 310—Junction U. S. 10 to Wyoming State Line.
5 MI Montana 32—Junction U. S. 310 to Wyoming State Line.
5 MY Black and White Trail.

Carter County

- 6 MA Montana 22—Wyoming Line near Alzada to Powder River County Line.
6 MJ Montana 7—Fallon County Line to Ekalaka.

Cascade County

- 7 MA U. S. 87, U. S. 89—Meagher County Line-Teton County Line and Judith Basin County Line to Armington Wye.
7 MB U. S. 91—Vaughn Wye to Teton County Line.
7 MC U. S. 91, Montana 29—Lewis and Clark County Line-Choteau County Line.
7 MD Montana 20—Lange's Corner to Lewis and Clark County Line.

Chouteau County

- 8 MA Montana 29—Cascade County Line-Hill County Line.

Custer County

- 9 MA U. S. 10—Prairie County Line-Rosebud County Line.
9 MB Montana 22—Powder River County Line-Garfield County Line.
9 MC U. S. 12—Junction U. S. 10 to Fallon County Line.

Daniels County

- 10 MA Montana 5—Sheridan County Line to Scobey.
10 MB Montana 13—Roosevelt County Line to Scobey.
10 MC Montana 13—Canadian Line south to Montana 5.

Dawson County

- 11 MA U. S. 10—Prairie County Line-Wibaux County Line.
11 MB Montana 14—Junction U. S. 10 to Richland County Line.
11 MC Montana 18—Junction U. S. 10 to McCone County Line.

Deer Lodge County

- 12 MA Montana 110—Silver Bow County Line to Granite County Line.
12 MB U. S. 10—Junction Montana 110 to Powell County Line.

Fallon County

- 13 MA U. S. 12—Custer County Line-North Dakota State Line.
13 MI Montana 7—Wibaux County Line to Carter County Line.

Fergus County

- 14 MA U. S. 87—Judith Basin County Line-Musselshell County Line.
14 MB Montana 18—Junction at Grassrange to Petroleum County Line.
14 MK Part of Montana 19—Lewistown-Roy.

Flathead County

- 15 MA U. S. 2—Glacier County Line-Lincoln County Line.
15 MB U. S. 93—Lake County Line-Lincoln County Line.
15 MC Junction U. S. 93 to Junction U. S. 2 at Columbia Falls.
15 MJ Junction U. S. 2 to Lake County Line.

Gallatin County

- 16 MA U. S. 10—Broadwater County Line to Park County Line.
16 MB Montana 191—Madison Line via Hebgen Lake to West Yellowstone-South to National Park Boundary.
16 MC U. S. 191—Idaho State Line to West Yellowstone.
16 MJ U. S. 191—Junction U. S. 10 to Yellowstone National Park Boundary.
16 MY Manhattan-South.
16 MZ Belgrade-Maudlow.

Garfield County

- 17 MA Montana 18—Petroleum County Line-McCone County Line.
17 MB Montana 22—Junction Montana 18 to Rosebud County Line.

Glacier County

- 18 MA U. S. 2—Toole County Line-Flathead County Line.
18 MB U. S. 89—Junction U. S. 2 at Glacier Park Wye to Canadian Line.
18 MC U. S. 89—Pondera County Line-Junction U. S. 2 at Blackfoot Wye.

Golden Valley County

- 19 MA Montana 6—Musselshell County Line to Wheatland County Line.

Granite County

- 20 MA U. S. 10—Missoula County Line-Powell County Line.
20 MB Montana 110—Deer Lodge County Line-Junction U. S. 10 at Drummond.
20 MI Montana 38—Deer Lodge County Line-Ravalli County Line.

Hill County

- 21 MA U. S. 2—Liberty County Line-Blaine County Line.
21 MB Montana 29—Havre-South to Chouteau County Line.

Jefferson County

- 22 MA U. S. 91—Helena-Junction U. S. 10-Alternate to Butte.

- 22 MB U. S. 10—Junction U. S. 10—Alternate to Silver Bow County Line.

Judith Basin County

- 23 MA U. S. 87—Cascade County Line—Fergus County Line.

Lake County

- 24 MA U. S. 93—Missoula County Line—Flathead County Line.

Lewis and Clark County

- 25 MA U. S. 91—Junction U. S. 10—Alternate at Helena—Cascade County Line.
25 MB U. S. 10—Alternate—Powell County Line to Broadwater County Line.
25 MC Montana 20—Junction Montana 33 at Augusta to Cascade County Line; Powell County Line to Junction Montana 33 at Hogan.
25 MD Montana 33—Junction U. S. 91 at Wolf Creek to Teton County Line.

Liberty County

- 26 MA U. S. 2—Hill County Line to Toole County Line.

Lincoln County

- 27 MA U. S. 2—Flathead County Line—Idaho State Line.
27 MB U. S. 93—Flathead County Line—Canadian Line.
27 MC Montana 37—Junction U. S. 93 at Eureka to Junction at Libby with U. S. 2.

McCone County

- 28 MA Montana 18—Dawson County Line via Circle to Garfield County Line.
28 MB Montana 13—Junction Montana 18 at Circle to Roosevelt County Line.

Madison County

- 29 MA Montana 191—Gallatin County Line to Junction U. S. 10.
29 MB Montana 41—Junction U. S. 10 to Twin Bridges.
29 ML Montana 34—Ennis—Ruby.

Meagher County

- 30 MA U. S. 89—Park County Line—Cascade County Line.

- 30 MB Montana 6—Broadwater County Line to Junction with U. S. 89; Wheatland County Line to Junction with U. S. 89.
 30 MI White Sulphur Springs to Broadwater County Line near Watson.

Mineral County

- 31 MA U. S. 10—Missoula County Line-Idaho State Line.

Missoula County

- 32 MA U. S. 10—Granite County Line-Mineral County Line.
 32 MB U. S. 93—Junction U. S. 10 to Lake County Line; Junction U. S. 10 to Ravalli County Line.
 32 MC Montana 20—Junction U. S. 10 to Powell County Line.

Musselshell County

- 33 MA U. S. 87—Yellowstone County Line-Petroleum County Line.
 33 MB Montana 6—Golden Valley County Line to Rosebud County Line.

Park County

- 34 MA U. S. 10—Gallatin County Line-Sweet Grass County Line.
 34 MB U. S. 89—Meagher County Line to Yellowstone National Park Line.

Petroleum County

- 35 MA Montana 18—Fergus County Line-Garfield County Line.

Phillips County

- 36 MA U. S. 2—Blaine County Line-Valley County Line.

Pondera County

- 37 MA U. S. 91—Teton County Line-Toole County Line.
 37 MB U. S. 89—Teton County Line-Glacier County Line.

Powder River County

- 38 MA Montana 22—Carter County Line to Custer County Line.

Powell County

- 39 MA U. S. 10—Silver Bow County Line to Granite County Line.
- 39 MB U. S. 10—Alternate—Junction U. S. 10 to Lewis and Clark County Line.
- 39 MC Montana 20—Lewis and Clark County Line via Ovando to Missoula County Line.

Prairie County

- 40 MA U. S. 10—Custer County Line-Dawson County Line.

Ravalli County

- 41 MA U. S. 93—Idaho State Line-Missoula County Line.
- 41 MI Montana 38—Junction U. S. 93 to Granite County Line.

Richland County

- 42 MA Montana 14—North Dakota State Line via Sidney to Dawson County Line.
- 42 MB Part of Montana 23—North Dakota State Line via Sidney to Roosevelt County Line.

Roosevelt County

- 43 MA U. S. 2—North Dakota State Line-Valley County Line, including 253.
- 43 MB Montana 16—Richland County Line-Sheridan County Line.
- 43 MC Montana 13—McCone County Line-Daniels County Line.

Rosebud County

- 44 MA U. S. 10—Treasure County Line-Custer County Line.
- 44 MB Montana 6—Junction with U. S. 10 to Musselshell County Line.
- 44 MJ Montana 45—Junction with U. S. 10 to Junction with Montana 8 at Lame Deer.

Sanders County

- 45 MA Montana 3—Junction U. S. 93 to Idaho State Line.
- 45 MB Montana 28—Junction Montana 3 to Flathead County Line.

Sheridan County

- 46 MA Montana 16 and Montana 5—Roosevelt County Line to Daniels County Line.

- 46 MB Montana 5—Junction Montana 16 at Plentywood to North Dakota Line.

Silver Bow County

- 47 MA U. S. 10—Jefferson County Line to Deer Lodge County Line.
47 MC U. S. 91—Junction with U. S. 10 to Beaverhead County Line.

Stillwater County

- 48 MA U. S. 10—Sweet Grass County Line to Yellowstone County Line.
48 MI Montana 21—Junction U. S. 10 to Golden Valley County Line.

Sweet Grass County

- 49 MA U. S. 10—Park County Line to Stillwater County Line.

Teton County

- 50 MA U. S. 89—Cascade County Line-Pondera County Line.
50 MB U. S. 91—Cascade County Line-Pondera County Line via Dutton.
50 MC Montana 33—Lewis and Clark County Line to Junction U. S. 89 at Choteau.

Toole County

- 51 MA U. S. 2—Glacier County Line to Liberty County Line.
51 MB U. S. 91—Canadian Line via Shelby to Pondera County Line.

Treasure County

- 52 MA U. S. 10—Rosebud County Line-Yellowstone County Line.

Valley County

- 53 MA U. S. 2—Phillips County Line-Roosevelt County Line.
53 MB Junction U. S. 2 to Fort Peck Dam.
53 MY F. A. P. 83.

Wheatland County

- 54 MA Montana 6—Meagher County Line to Golden Valley County Line.

Wibaux County

55 MA U. S. 10—Dawson County Line-North Dakota State Line.

Yellowstone County

56 MA U. S. 10—Stillwater County Line-Treasure County Line.

56 MB U. S. 87—Junction U. S. 10 to Musselshell County Line.

56 MC U. S. 87—Junction U. S. 10 to Big Horn County Line.

56 MY Polytechnic Road.

2.13 The order number denotes the class of the work, and must always be used. These numbers are as follows:

Order Numbers

(a) GENERAL MAINTENANCE:

1. All general maintenance items.

(b) SPECIAL MAINTENANCE.

2. Resurfacing and filler.
3. Guard fence.
4. Snow removal.
5. Bridges.
6. Slides, washouts, drainage.
7. Oiling.

(c) BETTERMENTS.

These orders will run consecutively regardless of class of work; numbers starting with 10.

2.14 The code numbers are used to show the segregation of work into its various phases. These numbers are as follows:

Code Numbers

(a) GENERAL OR SPECIAL MAINTENANCE.

21. Unsurfaced, rock or gravel.
22. Concrete, bituminous pavements and oiled surfaces (includes gravel shoulders)
23. Shoulders, ditches, etc. (Old 22)
24. Slides and washouts.
25. Guard fence and guide posts.
26. Snow removal (including sanding).

27. Bridges.
28. Signs and signals.
29. Center-line painting or striping.
30. Traffic counts and traffic surveys.
31. Rentals, light, power, heat, etc.
33. Erection and removal of snow fence.
34. Equipment parts, overhaul, and repair.
35. General superintendence.
36. Roadside beatification.

(b) BETTERMENTS.

41. Rock or gravel surfacing.
42. Grading including widening.
43. Culverts and drains.
44. Miscellaneous structures.
45. Guard fence.
46. Snow fence.
47. Bridges.
48. Signs and signals.
49. Concrete paving.
50. Bituminous paving.
51. Rock or gravel shoulders to pavement.
52. Oiled surface betterments.
54. Equipment parts, overhaul and repair.
55. Superintendence—general.

Number 21 is to cover the maintenance of the surface of all earth, rock or gravel surfaced sections and includes dragging, blading, scarifying, removing oversize and in short all maintenance of the roadway section from shoulder to shoulder.

Number 22 is to cover the maintenance of the roadway section of all concrete, bituminous pavements and oiled surfaces from shoulder to shoulder.

Number 23 includes all work outside the shoulders of the road such as shouldering up, drainage (both ditches and culverts), removal of weeds and trash and work around bridges on both 21 and 22 (Old 22).

Number 24 should be used in connection with slides and washouts which require additional forces. Work done by regular forces will be charged out under Number 23.

Number 25 includes painting, relining and all general maintenance on guard fence and guide posts. The repair of guard fence and guide posts injured by slides and washouts should be charged under Number 24, and small sections of guard fence continuous with bridge handrail should be charged to Number 27.

Number 26 shall include snow removal operations (including sanding).

Number 27 shall include all bridge repairs. Special section prefixes have been assigned to the larger bridges and will be used for larger jobs of maintenance, such as redecking, painting, bank protection, etc.

Number 28 covers maintenance and replacement of signs and signals.

Number 29 covers all charges for material and labor and for center-line painting or striping and protection.

Number 30 shall include all costs of traffic census and special traffic surveys which may be called for.

Number 31 shall include rentals for maintenance offices, field shops, garages, light, power, heat, etc. Division offices will continue to use their A-16 accounts as in the past.

Number 33 shall include work on snow fence and sloping cuts when such is done for the purpose of preventing drifts.

Number 34 shall include the maintenance of all equipment that carry a highway number, labor on overhaul, repair parts, mechanics' time, including gas, oil and grease used in transporting mechanic to make repairs. Tires, gas, oil, grease, cutting edges, broom filler, scarifier teeth and repairs to any equipment that does not have a highway number, such as fresnos, compressors, etc., are to be charged against the job and not against this number. This code is used on general maintenance only. Special maintenance or oiling takes code Number 22, etc.

Number 35 shall cover the time of Maintenance Superintendents and shall not include foremen, who shall segregate their time the same as the other laborers.

Number 36 shall include all labor and materials needed for upkeep of beautification projects.

2.15 Number 41 includes all work on re-
Betterments surfacing of old screened gravel sections which have not been surfaced under the $\frac{3}{4}$ inch specification. Resurfacing of sections which were constructed under the new specifications would be special maintenance and chargeable to maintenance code No. 21.

Number 42 shall not include widening where material is removed from slide, but shall include special widening jobs done under contract or by extra gang.

Number 43 shall include the replacement of wooden structures as a betterment. The replacement of metal or concrete culverts which have failed would be a general or special maintenance item, however, and would be charged under No. 23. A replacement of a small culvert which has proven too small, by a larger structure would be a betterment.

Number 44 shall cover retaining walls, powder houses, pipe lines and drinking fountains, and all miscellaneous structures.

Number 45 shall include only additions of guard rail and guide posts and not repairs.

Number 46 shall include only additions.

Number 47 shall include only additions.

Number 48 shall include only initial signing.

Numbers 49 and 50 shall include only additions and shall not include the repair of failures.

Number 51 shall include only the placing of gravel shoulders where they have not been previously provided. Repair of existing gravel or rock shoulders would be carried as general maintenance under Code No. 21 or 22.

Number 52 shall be only used upon special order, as oiling in general is purely a maintenance item and is covered under maintenance Code No. 22.

Number 54 shall include equipment parts, overhaul and repair. This code is used for all betterments except 41 and 52 where "x" should be used.

Number 55 shall cover only the time of superintendents, and shall not include foreman's time.

216 To further segregate cost data in connection with special maintenance, suffixes are added to Code Number 21 (Rock or gravel surfacing) and Code Number 22. These suffixes are as follows:

Code Number 21:

a—Purchase of quarries, royalty.

b—Transfer of equipment, freight and setup

- c—Operation of pit or quarry.
- d—Crushing.
- e—Hauling and spreading.
- f—Supervision (Foreman, Timekeeper).
- g—Road preparation.
- h—Spreading and processing.
- n—Application of binder.
- p—Stock piling.
- x—Equipment parts, overhaul and repair.
- y—Operation of cook house.

Note: Should the surfacing operation be a betterment, Code No. 41 should be used with the foregoing suffixes.

Code Number 22—Oiling:

- a—Cost of oil at destination.
- b—Transfer of equipment, freight and plant setup.
- c—Addition of rock screenings or squeegee and mixing.
- d—Application, heating and demurrage.
- e—Rolling, sweeping.
- f—Supervision (Foreman, Timekeeper).
- g—Preparation of macadam.
- h—Flagman, protection of traffic.
- x—Equipment parts, overhaul and repair.

Note: Should the oiling operation be a betterment, Code No. 52 should be used with the above suffixes.

2.17 In writing a charge, use first the section prefix, as 43 MA, followed by the
Maintenance order number, as "2", followed by the
Coding code number, as 21. This will be written 43 MA-2-21 and represents the placing of binder or resurfacing as a special maintenance under Order No. 2 on the Roosevelt Highway in Roosevelt County. Suffixes shall be used as required. 43 MA-3-25 would represent the placing of new guard rail or guide posts on the above mentioned section.

The section prefix, order number, and code number must appear in every instance, except in the case of general maintenance when the order number "1" may be omitted, as 23 MA-22 would be understood to mean 23 MA-1-22. Suffixes shall be used on all coding in connection with special maintenance or betterment orders covering surfacing and oiling. All maintenance charges, general or special, take code numbers 21 to 36; all betterments take code numbers 41 to 55.

2.18 M 20 Holding Account An M 20 holding account is assigned to Division and Resident Engineers and Maintenance Superintendents as a matter of convenience in coding and distributing supervision charges in connection with maintenance operations which cannot be readily and accurately charged to Code 35 or 55. At the close of the fiscal year these M 20 charges are pro-rated and charged back against the maintenance allotments under the jurisdiction of the person making the charge. In order that the accounting department may enter the charges against the right account, it is necessary in all cases that the initials of the Engineer or Maintenance Superintendent to whom the charge belongs immediately follow the M 20 and be supplemented by one of the following code numbers:

- 01 Salaries only.
- 02 Railway and other transportation and personal expenses including board, room, railway transportation requests or mileage, pullman accommodations, auto, team, and saddle-horse hire.
- 03 Automobile supplies and repairs.
- 04 Miscellaneous personal supplies, and services paid personally—includes postage, telephone, telegraph, etc.

For example: John Doe's payroll distribution shall show M 20-JD-01; purchase of gasoline for his car, M 20-JD-03, etc.

All Engineers and Maintenance Superintendents shall be especially watchful that this account is not made a "dumping ground" for miscellaneous charges.

2.19 Miscellaneous Coding As a matter of convenience, jobs and classes of expenditures, instead of being referred to by names are designated by numbers. The numbers used to designate jobs are called "job prefixes" and they usually consist of the Federal Aid Project number, and unit for construction, preconstruction, and right-of-way account, written thus: 160-D, Unit 2, C 17-01 for participating construction engineering salaries (Refer to Account Code). 160-D, Unit 1, CFA 19-01 for common excavation and borrow done by state forces (Refer Code 19). Work performed by contractor's forces, pole moving, etc., use code No. 18 (Account Code). F.A.P. 211-A, Unit 1, PC 11, etc. for preconstruction (Account

Code). 149-E, RW 1501, etc. for right-of-way claims (Refer Account Code). Signing (Account Code). Administrative (Account Code). These codes shall only be used by the Maintenance Department upon specific instruction from Headquarters.

2.20 Coding Claims Distribution shall be shown on the face of the original and duplicate invoices and claims in a legible and orderly manner. If there is not sufficient space on the face of the invoices or claims, distribution shall be shown on the back by turning the bill or claim in tumble form. In no case shall the distribution be shown on the short form jurat. The arrangement of the coding shall at all times be grouped according to (1) Administration, (2) Preconstruction, (3) Construction, (4) Construction Force Account, (5) Right-of-Way, (6) M 20-Maintenance Supervision, (7) Maintenance. Under these captions, the charges shall appear in numerical order. The following example will illustrate the correct form of coding:

A 11-03	\$ 1.50
A 11-04 .....	.45
149-E Unit 1, PC 11-03	3.00
252-C PC 11-04	3.25
132-E, Unit 2, C 16-03	4.65
132-E, Unit 2, C 17-03	6.55
132-E, Unit 2, C 17-04	5.20
235-D, Unit 4, CFA 1912	4.45
236-B, Unit 4, CFA 1932-a	5.55
236-B, Unit 4, CFA 1932-f	3.67
252C, RW 15-03	8.32
M 20-JD-03	16.55
3 MA-21	3.56
3 MA-25	25.66
3 MA-2-21d	9.65
3 MA-7-32c	16.55
3 MA-10-47	21.66
3 MA-11-52d	1.55
50 MA-22	2.44
	<hr/>
	\$ 144.21

The total of the distribution must in all cases agree with the total of the claim and purchase orders.

2.21 Purchases General (c) PURCHASES. With the exception of emergency purchases, all purchases are to be made thru the State Purchasing Agent on requisition or

from dealers authorized by the State Purchasing Agent. All materials, supplies, etc., need of which can be anticipated, shall be requisitioned. On small purchases, which will probably be made locally, dealers' bids should be submitted with the requisition. Gravel or rock for surfacing shall be requisitioned, giving name of owner of pit, price, and approximate yardage to be used. The authorized dealers are to furnish materials and supplies on a monthly basis, purchases to be confirmed at the close of the month by the State Purchasing Agent. At the time purchases are made from authorized dealers a field purchase order (No. 2a) shall be given. At the close of the month a bill shall be submitted by the dealer, invoiced in triplicate, with jurats in duplicate, accompanied by the original emergency field purchase orders (No. 2a). This bill shall be checked and approved in the Division Office, yellow copies of Emergency Field Purchase Orders attached, and a request made on Form 76 that the purchases be confirmed. This requisition (Form 76) should show the first and last dates appearing on the invoice with a notation requesting that the purchases on the attached claim be confirmed, together with a general explanation as to why it was necessary to make purchase on E. F. P. O. This explanation should not refer to that given on individual E. F. P. O's., or be just a form statement such as "Could not be anticipated", etc. The claim should then be forwarded to Headquarters for further attention. The Equipment Department will list the items covered by the invoice on the Purchasing Department's confirmation requisition form, assigning a purchase order number to the confirmation requisition. A copy of this requisition will be returned, together with the duplicate of the requisition (Form 76) to the Division Office. This procedure will eliminate the necessity of itemizing requisitions in the field and the delay in clearing this class of claims for payment. Where a requisition covers a request for supplies to be purchased, the duplicate of Form 76 will be returned to the Division Office with the number of the requisition submitted to the Purchasing Department. When the purchase order has been issued the yellow or quadruplicate copy will be mailed direct to the source of the requisition. In submitting claims covering purchases of this nature the District Office will attach this yellow copy of the purchase order to the invoice in triplicate and jurat in duplicate before sending to Division Offices where the yellow copy of the purchase order will be retained for their files after the claim has been checked and approved.

2.22**Purchase of
Gas, Oil,
Grease**

Contracts for supplying gas, with the exception of carload purchases, oil, and grease are let by the State Purchasing Agent for six-month periods.

Upon a request from Headquarters, the Division Engineers shall furnish a list of dealers in the respective towns in their divisions who are capable of supplying the necessary service. In cases where a contract is given and the service is not satisfactory, Division Engineers will promptly report to Headquarters, giving in detail, the reasons why the dealer is not giving satisfactory service. Headquarters Office will then request the State Purchasing Agent to cancel the contract and enter into a new contract with another dealer. In case where gas, oil and grease cannot be obtained from the contract dealer, due to the fact that his place of business is closed or he is out of stock, purchases may be made from dealers who have no contract, on emergency field purchase orders, making a notation in the remark column or on the back thereof, showing the reason for the purchase, for instance, "Contract Station Closed." An emergency field purchase order must be issued for all purchases of gas, oil, and grease, regardless of the fact that the purchase is covered by a state purchase order contract.

2.23**Emergency
Purchases**

Emergency field purchases are to be made when a delay in securing supplies or parts thru the Purchasing Agent or his authorized dealers would result in loss of time of employees and laying up of equipment or incurring loss to the Department. The purchases shall be made on an emergency field purchase order at the best price obtainable, and the purchase shall not be confirmed if amounting to \$1.50 or less. Emergency field purchase orders shall be issued in all cases of emergency purchases at the time of the purchase. The practice of writing emergency field purchase orders when the bill covering monthly purchases is received will not be tolerated. Division Engineers shall be held responsible for all emergency field purchase order books and they should be issued to no one but responsible employees. Emergency field purchase orders must be signed by the person making the purchase, and show the details of the purchase, account, code and equipment number.

2.24 (f) CLAIMS. All claims against this
Claims department for personal expense, labor
General (to be paid from the revolving fund)
freight, express, telephone and tele-
graph, shall be made in duplicate on Form 23. These
claims need not be covered by purchase orders. All
other claims for materials and supplies shall consist of
three copies of the vendor's invoice with jurats in dupli-
cate and necessary purchase orders, this includes emer-
gency purchases as well as all purchases made or con-
firmed by the State Purchasing Agent.

2.25 When the vendor holds a contract for
Claims the delivery of gasoline, and purchases
Gas and Oil are made of oil, storage, etc., not in-
cluded in his contract, he shall include
these items in his claim covering gas, in the same man-
ner as if covered by the contract. It is not necessary to
issue separate emergency field purchase orders for the
miscellaneous items except as noted in the following
paragraph.

When the vendor is acting as an agent for a manu-
facturer of gasoline and he delivers oil, storage, etc.,
for his own account, a separate claim shall be submitted
for the gas in the name of the manufacturer having the
contract, with emergency field purchase orders at-
tached, and a claim shall be submitted in his own name
for oil, storage, etc., with emergency field purchase
orders attached. This claim shall be approved in the
regular manner and forwarded to Headquarters with
request for confirmation. In this case it will be neces-
sary to issue separate emergency field purchase orders.
The reason for this is readily apparent when one under-
stands that when we buy from a manufacturer, the State
Highway Commission is exempt from paying the Fed-
eral Gas Tax, and when purchases are made from other
than a manufacturer, the tax must be paid.

2.26 Field men shall be responsible for the
Submission prompt submission of claims. Assis-
tance may be given to vendors when
needed, but it shall not be the policy of the Department
to prepare claims for the vendor. All claims shall be
submitted thru the Division Office where they shall be
checked in every detail, and approved, before submitting
to Headquarters.

CHAPTER III

ACCOUNT CODE AND CLASSIFICATION

Note: Always use both the proper prefix and suffix, for example—C17-01; PC11-03; M22-04.

ADMINISTRATIVE CODE HELENA & DIVISION OFFICES PREFIXES DEPARTMENT DIVISIONS CODE LETTER "A"

Helena Office

- A1 Commissioner and commission
- A2 Chief Engineer and staff—including chief, assistant chief, construction engineers and such other personnel as may be assigned
- A3 Bridge division—including bridge engineer and assistants
- A4 Accounting division
- A5 Stenographic division—including secretary and chief clerk, stenographers, and file clerk
- A6 Office engineering division—including office engineer and assistants, estimate and federal aid clerks
- A7 Drafting division (only such time that is not chargeable to pre-construction, construction or maintenance)
- A8 Testing division (only such time that is not chargeable to pre-construction, construction or maintenance)
- A10 Helena office—general and miscellaneous accounts.

Field Division Offices

- A11 Division office No. 1 Butte
- A12 Division office No. 2 Great Falls
- A13 Division office No. 3 Billings
- A14 Division office No. 4 Wolf Point
- A15 Division office No. 5 Missoula
- A18 Border Transport Inspection
- A201 Tourist Traffic Industry Survey

**HELENA & DIVISION OFFICES
SUFFIXES
DEPARTMENT DIVISIONS
CLASSIFICATION OF ITEMS**

- 01 Salaries only
- 02 Railway and other transportation and personal expenses including board, room, railway transportation requests or mileage, pullman accommodations, auto, team and saddle horse hire, and subsistence stores
- 03 Automobile supplies and repairs
- 04 Miscellaneous personal supplies and services paid personally—includes postage, telephone, telegraph, etc.
- 05 Maintenance office equipment
- 06 Rental office equipment
- 07 Office telephone and telegraph
- 08 Express, freight, and drayage
- 09 Office supplies
- 10 Postage and stamped envelopes
- 11 Premium employees bond and Notary commission
- 12 Industrial accident insurance
- 13 Fire and liability insurance
- 14 Blue print supplies
- 15 Technical publications, magazines, association dues, etc.
- 16 Heat, light, power, rent, and janitor
- 17 Federal aid general expense
- 18 Maintenance field engineering equipment
- 19 Field engineering supplies
- 20 Drafting room supplies
- 21 Legal advice
- 22 Photographs and highway maps
- 23 Testing supplies
- 24 Outside sampling
- 25 Mess supplies
- 27 Traffic census (used with M20)
- 28 Standard plans
- 29 Specifications
- 34
- 35 Fair exhibit

- 36 Biennial report
- 37 Conference expense
- 38 Legislative and advertising
- 39
- 40 Bond sale expense
- 41 County engineering expense and consultations

EQUIPMENT DIVISION—HELENA **PREFIX** **CODE LETTER "A"**

- A-9 Equipment division—includes mechanical supt., shop foreman, clerks (office or stock) or any labor or supplies not allocatable to specific job

SUFFIXES **CLASSIFICATION OF ITEMS**

- 01 Salaries only
- 02 Railway and other transportation and personal expenses including board, room, railway transportation requests or mileage, pullman accommodations, auto, team and saddle horse hire, etc.
- 03 Automobile supplies and repairs
- 04 Miscellaneous personal supplies and services paid personally—includes postage, telephone, telegraph etc.
- 05 Maintenance office equipment
- 06 Rental of office equipment
- 07 Telephone and telegraph
- 09 Office supplies, etc.
- 10 Postage and stamped envelopes
- 16 Heat, light, power and rent
- 26 Machine shop supplies
- 30 Maintenance—road and fence
- 31 Maintenance of rented equipment
- 32 Maintenance of shop equipment
- 33 Suspense clearing account

**OPERATIVE ENGINEERING
PREFIXES PROJECT NUMBER AND
PRE-CONSTRUCTION CODE LETTER P. C.**

P.C. 10	Reconnaissance
P.C. 11	Preliminary and location survey, roads
P.C. 311	Preliminary and location survey, bridges
P.C. 12	Plans, specifications and estimates, roads
P.C. 312	Plans, specifications and estimates, bridges
P.C. 13	Location and testing materials
P.C. 14	Plan in hand inspection
P.C. 15	Advertising and contract letting
P.C. 15-2	Right of way expense, including maps, etc.
P.C. 316	Test holes for bridge foundations
P.C. 50	Beautification

**SUFFIXES
OPERATING ENGINEERING**

- 01 Salaries only
- 02 Railway and other transportation and personal expense, including board, room, railway transportation request or mileage, pullman accommodations, auto, team and saddle horse hire and subsistence stores
- 03 Automobile supplies and repairs
- 04 Supplies—telephone and telegraph, postage, and all miscellaneous expense

Note: When tests are made of materials for a project in the preconstruction stage, the charge will be made by the testing division or the employee obtaining samples to P.C. 13.

RIGHT OF WAY PAYMENTS

(Construction Item)

PREFIX PROJECT NUMBER AND "RW" CLASSIFICATION OF ITEMS

- RW-15-01 Salaries only
- RW-15-02 Railroad transportation
- RW-15-03 Automobile expense
- RW-15-04 Miscellaneous
- RW-15-12 Right of way maps
- RW-15-29 Fencing Allowance
- RW-15-30 Damages
- RW-15-31 Purchase of real property
- RW-15-32 Payments of judgments granted by court
- RW-15-33 Attorney fees, court costs
- RW-15-38 Gravel pits
- RW-15-39 Miscellaneous right of way expenses

OPERATIVE ENGINEERING

PREFIXES

CONSTRUCTION CODE LETTER "C" PREFIXED BY PROJECT NUMBER AND UNIT

- C16 Supervision and nonparticipation charges by:
 - Division heads
 - Field division engineers
 - Testing engineers
 - and all other nonparticipation items
- C17 Construction engineering charges by:
 - Resident supervisors
 - Staking parties
 - Inspectors
 - and all other charges eligible for Fed. Aid.

SUFFIXES OPERATIVE ENGINEERING

- 01 Salaries only
- 02 Railway and other transportation and personal expense, including board, room, railway transportation request or mileage, pullman accommodations, auto, team and saddle horse hire, and subsistence stores
- 03 Automobile supplies and repairs
- 04 Supplies—telephone and telegraph, postage, and all miscellaneous expense

Note: When tests are made of materials for a project in the construction stage, the charge will be made by the testing division or by the employee obtaining samples, to C16.

The classification of laborer, truck driver, sectionmen, teamster, and maintenance engineer is not eligible for Federal Aid and must not be coded to C17, except when a satisfactory explanation can be given. When employees of this class are used, a memorandum must be attached to the construction payroll giving a full explanation.

CONSTRUCTION PAYMENTS PREFIX "C" NO. 18

PREFIXED BY PROJECT NUMBER AND UNIT

- C1801 Payments to contractor
- C1802 Payments to counties, force account work
- C1803 Payments for materials
- C1804 Payment for removals, damage, etc.

CONSTRUCTION FORCE ACCOUNT
PREFIX "CFA"
NO. 19

PREFIXED BY PROJECT NUMBER AND UNIT

CFA1901	Common excavation and borrow
CFA1902	Rock excavation
CFA1903	Intermediate excavation
CFA1904	Overhaul
CFA1905	Retaining wall
CFA1906	Drainage structures—includes culverts, all labor and material
CFA1907	Removal (tel. tel. and fences)
CFA1908	Random rip rap
CFA1909	Clearing
CFA1910	Guard rail
CFA1911	Cattle passes
CFA1912a	State furnished gravel
CFA1912b	Binder
CFA1912c	Overhaul on binder
CFA1912d	Processing
CFA1912e	Hauling
CFA1912g	Preparation of grade
CFA1913	Mess house operation (deductions for board to be credited to)
CFA1914	Building temporary road
CFA1915	Moving camp
CFA1916	Transportation, supplies, materials and mess supplies
CFA1917	Snow fence
CFA1918	Office expense
CFA1919	Transportation
CFA1920	Camp equipment
CFA1921	Allowances to convicts
CFA1922	Planting trees

Note: In addition to the above code CFA19, special force account codes will be issued from Headquarters covering all force account work on which Federal Aid is involved.

**OPERATIVE ENGINEERING
PREFIXES
MAINTENANCE CODE LETTER "M"**

- M20 General Supervision by Maintenance Superintendent and Assistants, Field Division Engineers
Suffix—Initials of Engineer incurring expense.
For example: M20-EBD-03
- M22 Maintenance
(See sub-divisions set up in Maintenance Code)
- M30 Distribution of Gasoline and Oil from Storage
Prefix M30—Suffixes 1 to 12
- 1 Butte
 - 2 Great Falls
 - 3 Billings
 - 4 Wolf Point
 - 5 Missoula
 - 6 Havre
 - 7 Bozeman
 - 8 Lewistown
 - 9 Glendive
 - 10 Helena
 - 11 Miles City
 - 12 Kalispell

Each suffix shall carry all charges for labor and supplies.

M21 Holding Account for Equipment Overhaul

- 1 Division One
- 2 Division Two
- 3 Division Three
- 4 Division Four
- 5 Division Five
- 6 Helena Shop

Each suffix shall carry all charges for labor and material. This account shall be credited for all charges transferred or distributed to Maintenance and Construction accounts.

CONSTRUCTION PAYMENTS SIGNING HIGHWAYS

- SA23 U. S. 10 Yellowstone trail
U. S. 10 North and U. S. 10 South
- SB23 U. S. 12 Baker-Terry
- SC23 U. S. 87 Gardiner-Neihart and U. S. 87 West
- SD23 Mont. 110 Junction with U. S. 10S near Cracker-ville thru Anaconda and Philipsburg to Junction with U. S. 10 at Drummond
- SE23 U. S. 2 Roosevelt Highway
- SF23 U. S. 87 East—Y. G. B. South of Neihart
- SG23 U. S. 91 Dillon-Butte-Helena-Great Falls
- SH23 U. S. 93 Hamilton-Missoula-Kalispell-Eureka
- SI23 U. S. 310 Frannie-Laurel
- SJ23 Mont 3 Junction with U. S. 93 at Ravalli thru Paradise, Plains, Thompson Falls to Idaho line near Heron
- SK23 Mont. 11 Junction with U. S. 87 at Vaughn thru Conrad and Shelby to the Canadian Line
- SL23 Mont. 14 Junction with U. S. 10 at Glendive North thru Sidney to State Line near Fairview
- SM23 Mont 22 Wyoming Line near Alzada North thru Broadus, Miles City, Jordan, Glasgow and Opheim to the Canadian Line
- SN23 Mont. 29 Junction with U. S. 87 at Great Falls North thru Fort Benton and Havre to the Canadian Line
- SP23 Marking Historical and Scenic Points Throughout the State

SUFFIXES

- a Labor only
- b Railroad and other transportation
- c Automobile supplies and repairs
- d Materials, tools and supplies
- e Supervision

No charge to be made this % except by signing crew.

"See Maintenance Code 28 for sign repairs."

CAPITAL ASSETS
PREFIX LETTER "CA"
OFFICE FURNITURE AND FIXTURES

CA-40	Office furniture and equipment
40-1	Commissioner's office
40-2	Chief engineer and Ass't. office
40-3	Bridge division
40-4	Accounting division
40-5	Gen. clerical division
40-6	Gen. office engineering division
40-7	Gen. office drafting division
40-8	Testing division
40-9	Equipment division
40-RW	Right of way division
40-D1	Division office No. 1 Butte
D2	Division office No. 2 Great Falls
D3	Division office No. 3 Billings
D4	Division office No. 4 Wolf Point
D5	Division office No. 5 Missoula
D6	District office No. 6 Havre
D7	District office No. 7 Lewistown
D8	District office No. 8 Bozeman
D9	District office No. 9 Glendive
D11	District office No. 11 Kalispell
D12	District office No. 12 Miles City

CA-41	Engineering equipment
41-1	Instruments
41-2	Tools
41-3	Camp equipment

The above accounts require an inventory of office furniture and equipment to be submitted as of June 30 for each fiscal year. This inventory shall be separate for each office in the Capitol, Division and District office.

CAPITAL ASSETS
BUILDINGS—PREFIX LETTER "CA"

CA42-6	Helena
7	Great Falls
8	Bozeman
9	Havre
10	Billings
11	Wolf Point
12	Butte
13	Missoula
14	Lewistown
15	
16	
17	
18	
19	

Suffixes—Classification of Cost Items
(61 to 79 for use with State Forces)

CA42-6-60	Payments to contractor
1	Labor shop building
2	Labor power and lights
3	Labor heating plant
4	Labor water and sewer
5	Labor bins
6	Labor office
7	Labor hangars and outside stores
8	Labor driveway, fence, and railroad spurs
9	Labor painting
71	Material shop building
2	" power and lights
3	" heating plant
4	" water and sewer
5	" bins
6	" office
7	" hangars
8	" driveway, fence and railroad spurs
9	" painting
80	Deductions from contractor
1	Purchase of land
2	Architect's fees and advertising
3	Trees and planting
90	Depreciation

Note: When a new building or addition is added, a sub % (CA42A, etc.) will be assigned by the Helena office for the purpose of assembling all charges incurred for construction. This sub % will be closed into CA42 on completion.

**CAPITAL ASSETS
PREFIX LETTER "CA"**

CA44 Shop Tool Equipment

SUFFIXES

- 1 Missoula
- 2 Great Falls
- 3 Billings
- 4 Wolf Point
- 5 Butte
- 6 Havre
- 7 Lewistown
- 8 Bozeman
- 9 Glendive
- 10 Helena
- 11 Kalispell
- 12 Miles City

The suffixes of this code shall include all charges for freight, drayage and handling.

An inventory must be submitted to the Equipment Superintendent at Helena as of June 30 of each year and at more frequent intervals if he requests it.

CAPITAL ASSETS
STORAGE FACILITIES FOR CARLOAD
STORAGE OF GASOLINE AND ROAD OIL
PREFIX LETTER "CA"
(Formerly % E-26)

CA45-10	Billings
11	Great Falls
12	Butte
13	
14	Wolf Point
15	Missoula
16	Havre
17	Bozeman
18	Lewistown
19	Glendive
20	Helena
21	Miles City
22	Kalispell

This code shall carry all charges for tanks, motors, pumps, pipe lines, loading platforms and labor for installing. In all cases where new units are installed, the Helena office will issue authority for a sub-account (CA-45-10A, etc.) in order that the cost may be assembled for each unit. Complete details covering the unit to be installed, such as location, size or capacity, railroad facilities, etc., shall be furnished the Helena office when making a request for a new or additional installation.

CAPITAL ASSETS
REPAIRS AND MAINTENANCE OF SHOP
BUILDINGS
PREFIX LETTER "CA"

CA47-6	Helena
7	Great Falls
8	Bozeman
9	Havre
10	Billings
11	Wolf Point
12	Butte
13	Missoula
14	Lewistown
15	
16	
17	
18	
19	

Suffixes and Classification of Cost Items
(61 to 79 for use with State Forces)

CA47-6-60	Payments to contractors
1	Labor shop building
2	Labor power and lights
3	Labor heating plant
4	Labor water and sewer
5	Labor bins
6	Labor office
7	Labor hangars and outside stores
8	Labor driveway and fence
9	Labor painting
71	Material shop building
2	" power and lights
3	" heating plant
4	" water and sewer
5	" bins
6	" office
7	" hangars
8	" driveway and fence
9	" painting
80	Deductions from contractor
3	Trees and shrubbery

Note: Account CA47 to be closed to Depreciation %.

CAPITAL ASSETS
PREFIX LETTER "CA"
INVENTORY REQUIRED AS OF JUNE 30

- CA50 Major Equipment
- 1 Automobiles
 - 2 Trucks
 - 3 Tractors
 - 4 Power graders and scarifiers
 - 5 Crushers and gravel plants
 - 6 Steam and power shovels
 - 7
 - 8
 - 9
 - 10
 - 11 Depreciation
- CA60-1 Miscellaneous Equipment

The above accounts require the submission of an annual inventory containing the physical assets of the Highway Commission, the value of the assets shown on the last inventory, depreciation or appreciation and the net value to date. The fiscal year ends the 30th day of June of each year.

**CAPITAL ASSETS
PREFIX LETTER "CA"
SHOP STORES**

CA55-10 Helena Shop stores

This account includes all Store items such as tires, tubes, shovels, hand tools, auto and truck parts, etc. When issued from stores, they are to be charged to the proper account and credit passed to this account; in the case of charges to construction force account and construction engineering, for the purpose of collecting Federal Aid, an itemized statement must accompany the charge.

CAPITAL ASSETS
DIVISION STORES ACCOUNT
PREFIX LETTER "CA"

CA56-1	Missoula
2	Great Falls
3	Billings
4	Wolf Point
5	Butte
6	Havre
7	Lewistown
8	Bozeman
9	Glendive
10	Helena
11	Kalispell
12	Miles City
13	
14	
15	

Suffixes

CA56-1-01	Grader Blades
02	Culvert pipe
03	Gasoline
04	Road oil

Inventory is required every thirty days. This inventory shall show quantities on hand, amount purchased during the month, amount distributed, and account to which the distribution shall be charged. Use Form 88.

SUNDRY ACCOUNTS

The following accounts are not to be used in the Field except on written authority from Headquarters.

S-61 Road Maps (G.L. Acct. 344)

S-62 Helena Office Stores

E-25-18 Scales, etc., for Border Inspection

AR-500, etc. Accounts Receivable (to be assigned on written authority from Helena office)

W. O. 1000, etc. Work Orders; to be used in conjunction with preconstruction, right of way and construction. When requesting a work order number, give full description of project and purpose for which the work order is desired. Written authority will be furnished from Headquarters.

CHAPTER IV

EQUIPMENT DEPARTMENT

1. ORGANIZATION

4.1 Headquarters (a) **GENERAL.** The Equipment Department has charge of procuring, maintaining and disposing of motor vehicles and all major equipment, and the designing and construction of specialized equipment used by the Highway Commission. This Department is under the direct charge of the Equipment Superintendent, who is the representative of the Maintenance Engineer in matters pertaining to equipment, shops, stores, etc.

4.2 Division Shops Division shops are located at the Division headquarters and are in direct charge of a Division Mechanic, who is responsible for the upkeep of the equipment within the territory assigned to him by the Division Engineer.

4.3 District Shops District shops are maintained in addition to the division shops. District shops are under the direct supervision of a District Mechanic, and he is responsible for the upkeep of the equipment within the territory assigned to him by the Resident Engineer or Maintenance Superintendent and the Division Engineer.

All shops, whether owned by the State Highway Commission or rented for their use, are not to be altered or remodeled in any way unless approval has been secured from Headquarters.

4.4 Equipment Superintendent (b) **DUTIES.** The Equipment Superintendent exercises general supervision over all equipment purchases and disposals, purchases of repair parts, stores, etc., and the construction and maintenance of shop facilities. The Equipment Superintendent is available for consultation with the field men at any time that he can be of assistance or service to them. Requests of this nature shall be transmitted through the Division Offices and approved by the Maintenance Engineer.

4.5 Master Mechanic The Master Mechanic is the headquarters assistant to the Equipment Superintendent, and is in direct charge during the absence of the Equipment Superintendent. He is responsible to the Equipment Superintendent for all headquarters shop activities and personally supervises all major and special overhauling, and the design and construction of special equipment undertaken by the headquarters shop. The Master Mechanic is subject to call at all times by the Field men when he can be of any service or assistance to them in matters pertaining to major overhauling or in altering the design of equipment. Requests for his assistance must be submitted through the Division Office to headquarters for the approval of the Maintenance Engineer and the Equipment Superintendent.

4.6 Equipment Clerk The Equipment Clerk is an assistant to the Equipment Superintendent in all matters pertaining to equipment records, costs, and accounting, and is Acting Equipment Superintendent in the absence of both the Equipment Superintendent and the Master Mechanic. He is responsible for the headquarters' stocks and stock room as well as the field stores accounting, and all records, files and accounting pertaining to motor vehicles and major equipment.

4.7 Division Mechanic The Division Mechanic is directly responsible for all overhaul work done within the Division Shop and is to make periodical inspection trips during the operating season to determine the condition of the equipment within his jurisdiction and to ascertain if repairs are necessary. At the discretion of the Division Engineer or the Equipment Superintendent, he may be required to assist District Mechanics in special work. The Division Mechanic shall report to and through the Division Engineer.

4.8 District Mechanic The District Mechanic is responsible for the overhauling and upkeep of all equipment within his territory, and shall make periodical inspections of the equipment during the working season. The District Mechanic shall report to the Resident Engineer or the Maintenance Superintendent, who in turn shall report to the Division Engineer.

2. GENERAL DETAILS

4.9 The value to the State of any machine
Responsibility or piece of equipment depends on how
and it is operated and cared for while in
Protection service. The amount and cost of main-
 tenance on road machinery depends
primarily on the kind of work to which it is assigned
and the conditions under which it is operated. These
conditions are greatly influenced by the supervising and
operating personnel. They are responsible for what
might be called preventive maintenance. Those who
are responsible for the placing of the equipment in the
field should give considerable thought to whether the
equipment is fitted to perform the work to which it
is assigned; for instance, it is undesirable to place a motor
patrol, regardless of make, on ditching or shouldering
up operations. This type of equipment is designed for
surface work, and in order that upkeep may be kept at
a minimum, it must not be used in operations to which
it is unsuited.

4.10 It is not necessary to stock supplies
Stock of outside of current needs in any Dis-
Supplies trict Shop. The location of some of
 the Division Shops make it advisable
to carry a limited stock of parts and supplies which
have been charged out. However, stocks of this kind
must be limited to standard materials of common usage,
and on which expensive delay would ensue if they were
not available. No stock will be carried in a store ac-
count without permission and a "set up" from the Ac-
counting Department. The store accounts at present
are for grader blades, culvert pipe, gasoline and road
oils.

It is required that each shop, whether District or
Division, employ a "want book" to list their anticipated
requirements for stock and that requisition for same be
submitted at regular periods in place of submitting a
requisition for a dozen files today, five pounds of solder
tomorrow, etc.

When placing requisitions covering repair parts for
units of equipment, considerable assistance can be given
Headquarters if parts for various assemblies such as
motor, transmission, etc., are combined on the requisition.

tion. This precaution will also tend toward eliminating the possibility of mistakes in ordering when the requisition is placed with the State Purchasing Agent's office.

All small tools and supplies which are classed as expendible, such as shovels, picks, bars, fresnos, plows, rope, lanterns, etc., required for a season's maintenance work, shall be estimated and a copy of this estimate forwarded to Headquarters in accordance with form schedule furnished.

In making up this estimate a form will be furnished by Headquarters.

Purchase of the Department's needs will be governed by the estimate. All items such as plows, wheelbarrows, fresnos, etc., included on an estimate will be shipped direct. Other items, such as lanterns, bomb shell torches, axes, shovels, etc., of which a very favorable quantity discount can be secured by shipment to a central point, will be warehoused at Helena and will be forwarded to the field on requisition only.

When tools are received at the various field shops or warehouses, they shall be immediately charged out, and are not to be placed in a stores account.

4.11 Equipment shall never be borrowed
Borrowing of from any source until permission has
Equipment been secured from Headquarters.
Breakage or an accident with borrowed equipment often proves very costly. Under no circumstances shall any state owned tools or equipment be loaned or rented to any private person or concern.

4.12 No equipment shall be rented for
Rental of State use until authority is secured
Equipment from Headquarters, and then a very
definite agreement in writing shall be made with reference to repairs, supplies, rate of rental, etc. Request for rental of state owned equipment shall be referred to Headquarters for approval before entering into any agreement.

4.13 The following rental schedule shall
Rental be used whenever state owned equip-
Schedule ment is used on construction force
account work. Rates are on the basis of
an eight-hour day or fraction thereof:

Cars	Rates Per Day
Fords and Chevrolets	\$ 1.50
All Others	2.00

Trucks

Fords, Chevrolets, and Internationals	
1½ Ton or less	3.00
All Two Ton	4.00
All 3½ Ton	6.50
All 5 Ton	10.00
Five Ton with Oiler	15.00
Five Ton with Booster	12.00

Tractors

20 Cletrac—2 Ton & 20 Holt.....	3.50
30 and 5 Ton Holt	6.00
60 Holt and upwards	10.00

Graders

Team .....	.50
8 to 10 foot	1.50
12 foot	2.50
Motor Patrols with power	7.50

Miscellaneous

Killifer Road Disc	6.50
Killifer Scarifier	1.50
Compressor	3.50
Portable Boiler	3.00
Portable Retort	3.00
Road Brooms (not powered)	1.00
Road Brooms (powered)	5.00
Belt Loaders (powered)	2.50
Drag (Adams No. 6)	1.50
Drags (wood) .....	.50
Scarifier Graders	2.50
Rollers (5—6 ton)	5.00
Shovels (¾ or ½ cu. yds.).....	16.00

Snow Plows

Rotary Snow King	
(small & medium)	10.00
Rotary Snow King (large)	15.00
V Type Plows	5.00
Mouldboard Type Plows	2.50

4.14
New
Equipment
for Trial

No equipment will be tried out except upon strict understanding that the State is in no way obligated, and then only after an understanding with Headquarters and through them with

the State Purchasing Agent. A trial generally carries an obligation to purchase if the trial is acceptable, and furthermore the danger of an accident is always present.

Equipment which is offered for trial seldom is covered with Public Liability or Property Damage insurance, as State equipment is. An operator, if requested to operate a trial unit, would be personally liable for any accident that might occur while he was in charge.

4.15 Disposal of Equipment No equipment, parts or material owned by the State Highway Commission may be sold to its employees. When it is necessary to dispose of major equipment, the "Unserviceable Equipment Report" form shall be filled out and submitted to Headquarters for approval before salvage is started. Usually salvage that is secured from discarded equipment is of more value to the Department than any price it would be possible to secure for it were it offered for sale. Discarded repairs and parts such as tires, pistons, cylinder blocks, connecting rods, etc., which have been condemned must be destroyed immediately. Discarded tires and used oil or grease should never be allowed to accumulate at any of our shops. Accumulation of discarded supplies often leads to requests for them that put the Highway Commission in an embarrassing position when such requests are denied. Under no circumstances are discarded supplies to be given away or sold regardless of how worthy or extenuating the case may be.

3. SHOP INSTRUCTIONS

4.16 Personnel Qualifications All shop employees must be experienced, capable and honest, so that throughout their dealings with the field forces they may merit confidence and respect. Shop employees shall always be courteous and friendly. When employees suitable for shop work are unobtainable in a division, transfer of them from another division may be arranged for through Headquarters.

4.17 Working Hours All shop employees must be on duty from 8 A. M. to 12 A. M. and 1 P. M. to 5 P. M. except in special cases. During working hours, gossiping, loafing, or visiting shall not be permitted and will not

be tolerated. Tool salesman or others will not be permitted to do any canvassing of the employees during working hours. All shop employees will travel to and from work on their own time.

4.18 No work whatever shall be done on
State any privately owned equipment at any
Property for state shop. The buildings and facil-
Private Use ities at the various shops are State
owned property and are to be occu-
pied and used only in the interest of the State. The
loaning of shop tools or any other State property, either
to employees or to outside parties, is forbidden.

4.19 All buildings must be maintained in
Maintaining of good condition both inside and out.
Buildings, All dirt or rubbish must be cleaned
Yards, and up regularly and burned to prevent a
Tool fire hazard. The yards must be kept
Equipment clean and all equipment stored in
them, arranged in an orderly manner.
Tool equipment must be properly protected and cared
for. The abuse of tools will not be tolerated.

4.20 (a) **NEW EQUIPMENT.** A piece of
Equipment motorized equipment shall be taken to
Servicing the nearest State shop, where it shall
be serviced and checked over before
assigning it to duty. When new equipment is received,
a report of the serial and motor number shall be made
immediately to Headquarters, so that an equipment
number may be assigned and license plates secured if
necessary. The standard insignia shall be placed on
the left front door of all cars and trucks and on the
left hand side of other equipment in a suitable location
along with the equipment number assigned to the par-
ticular unit. This rule is void in some cases where
special permission has been secured from Headquarters.
A fire extinguisher must be mounted in each new car
or truck as soon as received.

(b) **USED EQUIPMENT.** When equipment is
brought to the shop for service and repair, inspection
shall be made of not only the parts upon which service
is requested, but also all others. The following parts
should be inspected on all motorized equipment when-
ever the shop employees have a chance:

1. Inspect the oil level and the condition of the oil.
2. Check radiator for cooling level liquid and leaks. If anti-freeze is being used, check protection to 20 degrees below zero or the temperature required.
3. Check gasoline supply.
4. Check brakes.
5. Check tire pressure.
6. Check steering gear.
7. Check transmission and rear end for the proper oil level.
8. Grease car when needed.
9. Inspect the battery for liquid level and corrosion.
10. Inspect the horn.
11. Check the lights—head light, tail light, and stop light.
12. Inspect the ignition and light wiring.
13. Check fire extinguisher.
14. Wash car when needed.

4.21

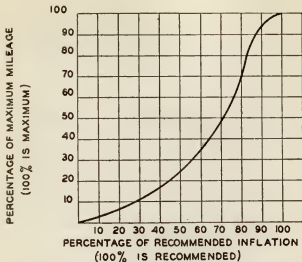
Recommended SAE Weights of Oil

No oil recommendations are made for any of our equipment. In each District we have a District Mechanic who is intimately acquainted with each motorized unit under his supervision as to mechanical condition of the unit and the work upon which it is being used. Should any difficulty be encountered in securing satisfactory operation on any motorized unit due to oil that is being used, report to headquarters. Special information or help will gladly be given in such cases.

4.22

Recommended Tire Pressure

There is one correct inflation for every condition of service, and to secure from a tire the maximum mileage that has been built into it, it is necessary to maintain at all times the exact recommended air pressure. As an example, if a 36 x 6 H.D. tire rated for an inflation of 90 lbs. air pressure, is operated at 63 lbs. pressure, the tire is being operated at only 70% inflation. Referring to the chart on next page, it will be seen that a tire operated at 70% recommended inflation or 30% under-inflation, will deliver but 48% normal service.



Pressure recommended for various size tires may be secured from our tire dealers. Their recommendations should be followed in all cases.

In the case of dual wheel equipment where it is necessary to replace a worn out tire with a new one, the new tire is to be placed on the inside where the additional load placed on it, due to its new higher tread, will not place an undue strain on the axle and bearings.

4.23

Painting

(a) EQUIPMENT. Before painting, clean the old surface thoroughly, being careful to remove all oil and grease. Road oil may be removed by spraying or painting the surface with a mixture of one part lubricating oil and one part gasoline. Allow the gasoline to evaporate and wash with soap and lukewarm water. Never use gasoline treated with lead compounds in this mixture. Sand off rust spots and very rough places. Prime where rust has been removed or where bare metal shows with white lead and raw linseed oil thinned to the right consistency with turpentine and let dry for twelve hours. All equipment with the exception of pas-

senger cars should receive one coat of paint each year and two coats if needed. The paint now being used by this Department is the product of the General Paint Corporation sold under the trade name of "Flex".

Flex No. 2603—Ojai Gray

Flex No. A9713—Highway Red

Flex No. 2603—Black

The Flex paint is only to be used on equipment except the small amount needed in making snow fence. Do not use it for other outside work such as painting guide posts, culvert markers, etc.

In using the Flex paint with spray gun, it should be thoroughly warmed before painting is started, a better job will result with a smaller amount of paint being used.

All passenger cars when in need of repainting will be painted in the original color combination. All trucks will be painted in Highway Red and black with the exception of Station Busses which will be painted in the original varnish and black paint. All tractors, shovels, graders (both pull type and motor patrols) and trailers used in transporting materials and equipment are to be painted Highway Red. All house trailers will be painted Ojai Gray. Boilers and retorts will be painted with black asphaltum paint.

(b) BUILDINGS. All timber or frame buildings, floors, and wood-work, either painted or varnished, shall be kept in first class condition by painting or varnishing when necessary in the original colors. All metal buildings shall be painted with gray Portland Cement paint and maintained in first class condition by repainting when necessary.

4.24

Shop Practice

(a) GENERAL. When a passenger car is brought into a shop to be worked on whether it be for a minor adjustment or major overhauling, precautions should be taken to protect the cushions from being soiled and the fenders from being scratched. Be sure the car will not soil the driver's clothes when it is turned back to him; that is, do not leave a dirty steering wheel, a greasy gear shifting lever, etc. Be as clean as possible when making repairs. Do not install parts before they are thoroughly washed.

When working on equipment and breakage or needed repairs which have not been reported are found, do not neglect them, but call the shop foreman's attention to them.

Do not turn out work that is not the very best, as the maximum is expected from the equipment, and it cannot be secured if repair work is slighted.

All shops are equipped with modern tools and appliances (limited in one or two cases) and they should speedily and economically turn out the average repairs. Work of unusual nature, beyond the capacity of the field shops can be handled at the Headquarters shop. All work must be done in State shops where possible and shop equipment permits. When it is necessary to send to Headquarters any piece of equipment for repair, be sure to send in a memo of detailed explanations also account number to which overhauling or repair is to be charged.

Headquarters, in nearly all cases, is able to furnish reconditioned motors for Ford cars and trucks and re-ground cylinder blacks with pistons fitted for F. W. D. trucks with no delay. Be sure motor numbers check with equipment records when an overhauled motor is installed in a truck or car.

(b) MOTOR OVERHAULING. Standard clearance allowance for gray iron piston skirts is .00075" (three-quarter thousandth) per inch of piston diameter for passenger car motors. When applied to different piston diameters, clearances are as follows:

- 2½" piston allow .002" clearance
- 3" piston allow .0025" clearance
- 3½" piston allow .003" clearance
- 4" piston allow .0035" clearance

Use a clearance of .001" per inch of piston diameter on pistons of motors subject to heavy duty, such as trucks and tractors, unless their motors are thoroughly run-in. Applied to a 4" diameter truck piston clearance allowance is .004".

Upper piston lands (sections above and between rings) must have additional clearance. Top land should have .0035" clearance per inch of piston diameter, second land .003" per inch, and the third land .002" per inch of diameter. Unless this clearance is allowed, extreme heating may cause piston head to seize and pull off.

Aluminum alloy split skirt piston clearance is the same as for cast iron pistons, except where special clearance is specified by the makers. Always follow manufacturers' recommendations.

When split skirt pistons are used it is important that the split be installed on the driver's side of the motor, as this is the side of minimum thrust.

Cylinder bores must be refinished to within one-thousandth of an inch (.001") for round and straight. This means half a thousandth (.0005") plus or minus a given size. Connecting rods and pistons must be in perfect alignment—at absolute right angles with crankshaft and cylinder. Always use a connecting rod and piston aligner.

Allow .0005" to .00075" (one-half to three-quarter thousandth inch) clearance for oil film when fitting piston pins to reamed holes. Pins bearing in cast-iron pistons should have no "drag", but should turn almost free. Oil thoroughly before assembling.

Do not assemble main and crankpin bearings tight to shaft, but in fitting, allow .001" clearance for each inch of pin diameter. End play on main bearings shall be .004" to .005" for regular sized motors and about .010" on big truck and tractors.

Piston Ring Gaps

Cylinder Bore	Gap	Cylinder Bore	Gap
2-3/4 - 2-7/8 .....	.015	3-7/8 - 4 .....	.021
2-15/16 - 3-1/16 .....	.016	4-1/16 - 4-3/16 .....	.022
3-1/8 - 3-1/4 .....	.017	4-1/4 - 4-3/8 .....	.023
3-5/16 - 3-7/16 .....	.018	4-7/16 - 4-9/16 .....	.024
3-1/2 - 3-5/8 .....	.019	4-5/8 - 4-3/4 .....	.025
3-11/16 - 3-13/16 .....	.020	4-13/16 - 4-15/16 .....	.026

When installing new valve seats in a motor block, be sure to use the proper size ring. Use a ring that has an inside diameter that is the same as the valve port. Use a standard size seat ring as recommended by the manufacturer whenever possible. Use the correct size pilot stem and select the cutter having the same number stamped on it as the ring has that is to be installed. Be sure the cutter is fully inserted in the shank, and securely fastened before starting work. The recess for the ring must be concentric with the valve guide and deep enough, so that the top of the ring is flush with the top of the block or cylinder head.

After installing valve seats always check the cylinder bore to see if it has been warped by the pressure of the ring. In all cases where a rebore or regrind is necessary in addition to new valve seats, insert the seats previous to reboring or regrinding the block.

Valve tappet clearance should agree with the manufacturer's recommendations.

4.25
Manufacturer's
Instructions
and Recom-
mendations Steering gears, transmissions, differentials, body hoists and pumps, brakes, etc., should be "set up" according to the manufacturer's instructions and recommendations.

4.26
Salvage
of Parts When bearings, connecting rods, and over-size pistons are in such shape that they may be reclaimed for further use, they shall be saved, and when an appreciable quantity is collected, sent to Headquarters. If parts are worn so that they cannot be used again, destroy them immediately.

4.27
Shop Tools All special tools are to be furnished by the State. Each mechanic shall furnish all tools necessary outside of special tools to take care of the work to which he is assigned.

4. OPERATING INSTRUCTIONS

4.28
General
Operating
Instruction The realization of a satisfactory investment in State equipment depends on the care and attention which the equipment receives. Every operating employee shall aid in making the investment profitable. Because of the varied character of equipment owned by the State Highway Commission, general instruction will apply to all units not mentioned in specific instructions.

At all times, all working parts shall be kept clean and well greased with the proper lubricants and correctly tightened.

Equipment in need of repair must not be used until after repairs have been made, if such use will materially increase the cost of repair.

All motor vehicles owned by the State Highway Commission and furnished employees are for use on State business only, and must not be used for private purposes. No person other than employees shall be allowed to ride in or on maintenance equipment.

When a car or light truck is assigned to an employee for any length of time, arrangements must be made for shelter and the necessary precautions taken to protect it from theft or other acts of vandalism.

Batteries and tires shall be inspected at regular intervals.

Practically all motorized equipment is furnished with an air cleaner of some type. These air cleaners shall be regularly inspected and cleaned. If neglected they restrict the air passage to the carburetor and have the same effect as that of choking the carburetor.

Oil filters shall be cleaned or a new cartridge installed whenever needed. The length of time an oil filter may be used without attention depends on the conditions under which the equipment is worked and how often the oil is changed.

Oil changes are to be made when required. The length of time that equipment may be operated between changes will depend on the mechanical condition of the equipment, and the kind of work that it is doing.

Radiators, pumps, and hose connection shall be inspected at regular intervals.

Brakes shall be kept in repair at all times and tested at regular intervals to see that they are functioning properly.

Motorized equipment which is able to travel under its own power shall not be trailed or towed.

No motorized equipment shall be coasted on grades or hills. The clutch and transmission must be engaged at all times when the equipment is in operation.

Governors, which are installed on various motorized units shall be functioning at all times and shall not be molested.

Mileage recording instruments such as speedometers and odometers must be kept in repair and operating at all times.

Accessories other than standard or original equipment shall not be installed on any unit until permission has been secured from Headquarters.

Fire extinguishers must be kept filled and in working condition at all times.

Read the instruction books accompanying each piece of equipment, and familiarize yourself with various adjustments as outlined by the manufacturer.

Do not overload equipment. It is designed and built for a maximum load by the manufacturer and if his recommendations are exceeded, the investment is jeopardized, the life of the equipment shortened through excessive strain, and voids any guarantee that the manufacturer has placed on it.

All operators of motorized equipment shall see that their equipment has the Highway insignia and equipment number, satisfactory lights or reflectors front and rear, and flags if safety requires them.

All brakes must be working at all times.

All operators shall take pride in the appearance of their equipment and keep it cleaned and in good repair, going over it at regular intervals, inspecting it for loose nuts and cap screws, broken or lost parts, and needed repairs. Every employee should make an effort to deliver the maximum in work accomplished with a minimum of expense in upkeep.

4.29 Employees are paid wages that warrant the securing of the better class of workmen, interested in their work and anxious to give full value in return for their wages. Employment of minors on work requiring motorized equipment operation shall not be permitted.

Operators who are careless or reckless with State equipment shall be discharged immediately. Any abuse of equipment that is brought to the attention of a Division Engineer, Resident Engineer, Maintenance Superintendent or Foreman by a mechanic must be thoroughly checked and the necessary action taken to stop such abuse.

Employees shall not criticize any state mechanical equipment except in a constructive way, and then only to responsible members of the Department whose busi-

ness it is to follow up and check these matters. Loose and thoughtless criticism only leads to trouble and embarrassment for those responsible for the purchase and upkeep of this equipment.

When a new piece of equipment is assigned, do not immediately decide that it will prove unsatisfactory, or that the manufacturer is wrong in his design, as the equipment was built for the work it is supposed to perform, and considerable time and money were spent in perfecting it before it was placed on the market. Do not be prejudiced but give it an impartial trial.

Operators and drivers of motorized equipment are not expected to be experienced mechanics, nor are they required to do major overhauling or repair work, but they must keep the equipment clean, well lubricated, and all bolts and nuts tight, and make minor repairs. Therefore each operator and driver must own, carry, and maintain the following kit of small tools:

- 1 Set of Socket Wrenches $\frac{1}{4}$ " to $\frac{3}{8}$ " SAE
- 1 Ten-inch Adjustable Wrench
- 1 Fifteen-inch Adjustable Wrench
- 1 Pair Adjustable Pliers
- 1 Set of Chisels $\frac{3}{8}$ ", $\frac{1}{4}$ " and $\frac{3}{4}$ "
- 1 Set of Punches, 1 each $\frac{3}{16}$ " pin, $\frac{5}{16}$ " common, $\frac{1}{4}$ " drift.
- 1 Six or Eight-inch Screw Driver
- 1 Twelve or Fourteen-inch Screw Driver
- 1 24 oz. Ball Pein Hammer

Additional tools may be required of drivers on special units at the discretion of the Division Engineer.

Special tools and equipment such as grease guns, jacks, air-pump, hub wrenches, tire chains, etc., peculiar to a certain piece of equipment will be furnished by the State and shall be checked out and in to the driver or operators of the equipment by a shop mechanic. Any shortage which cannot be explained or accounted for in a satisfactory manner by the operator or driver, when his assignment to duty on the equipment is completed, shall be replaced at his expense.

Under no circumstances is an operator or driver of motorized equipment to overhaul or attempt to overhaul a carburetor, generator, starting motor, magneto or distributor, as this work requires special tools and expert knowledge. Such repair work shall be done by a State Mechanic if possible.

4.30
Operation
of Cars

The most prolific source of motor car trouble is speeding. Drive at a reasonable rate of speed. Have the battery, tires and oil changes taken care of at regular intervals. Leaks in the cooling or oiling system must receive immediate attention, and brakes must be kept in good repair.

All unusual noises should be investigated and the cause located, for it may be the fore-runner of something serious. Only by close attention to the various details constituting the make-up of an automobile can the desired service, with minimum of interruptions, be obtained.

4.31
Truck
Operation

The proper gear or speed in which to operate a truck depends upon the type of work being done. It is not essential to operate at a speed in which the engine will have to labor at its maximum output to produce sufficient power to handle the job. Under these conditions the truck shall be operated in a lower gear which will eliminate heating, and excessive wear on all working parts because the motor will not be forced to labor and its performance will be smoother.

The motor shall at all times be kept as free as possible from dirt, and the magneto or distributor protected, not only from an accumulation of dirt, but also from grease and oil.

Truck tires are expensive and their life is considerably shortened through improper wheel alignment or operation when under-inflated.

Brakes must be kept in good repair and functioning properly at all times.

Sufficient water or an anti-freeze solution must be maintained in the radiator at all times during the operation of the equipment. Under no circumstances shall a volume of cold water be poured into the radiator when the motor is hot; allow the engine to cool off first.

Should a knock develop in the motor, ascertain the cause and report to the mechanic who is in charge of the equipment. Check the lubricant in the transmission and differential case at regular intervals, and change the oil when necessary.

Dump trucks equipped with hydraulic hoists shall be checked regularly for leaks and kept charged with the proper oil.

Whenever it is necessary to use chains on any make of four wheel drive truck, all four wheels must be chained.

Governors installed on trucks shall not be tampered with by any operator. If adjustment is faulty, correction is to be made by the Division or District Mechanic.

4.32 (a) **GENERAL.** When excessive wear occurs in the control mechanism of a grader unit, so that it is impossible to obtain positive control, necessary repair parts shall be requisitioned.

Blade lifting arms are fitted with take-up connection which shall be frequently inspected and tightened when wear develops.

All bolts and rivets shall be kept tight and all broken or lost ones replaced with the proper size.

Electric welding on frame should be inspected periodically for failures or fractures.

Bent blade horns or moldboard supports shall be straightened immediately or replaced with new ones.

Worn cutting edges shall be replaced previous to an injury to moldboard or braces thereon.

All wheels are fitted with roller bearings and all gear housings shall be kept full of the proper lubricant.

Solid rubber tires on all grader units shall be replaced when worn to within one inch of the tire rim.

Operators of leaning wheel graders shall always keep the wheels at the proper angle to the work so as to balance the thrust load and prevent undue wear on the wheel bearings and spindles. When a leaning wheel grader is being moved to or from work, or is stored or left standing the wheels must be in a vertical position.

When an extension on a grader moldboard is being used, extreme care shall be taken to eliminate excessive strain on the grader.

(b) **PULL TYPE GRADERS.** Care shall be taken to keep the pole of the grader at right angles to its king bolt, so that strains will not be against the fifth

wheel, or undue cramps caused to the steering devices. This can only be accomplished with a short and positive hitch on surface maintenance.

No pull type grader shall be operated without the standard size safety pin made up from the recommended material.

No pull type grader shall be operated, towed or trailed without a responsible employee on the operator's platform. A safety chain must also be used.

(c) **MOTOR PATROL OPERATION.** Motor patrols shall only be used on surface maintenance, and shall never be used on ditching operations. Should it be necessary to use a motor patrol off of the road surface, such as mixing oil stock material, the operation shall be confined to a smooth level surface.

The governor on motor patrol power units must be operative at all times and shall not be tampered with except by a mechanic authorized to do so. The setting of the governor should be checked periodically by a mechanic to see that the motor is operating at the speed recommended by the manufacturer.

The pumps on hydraulic motor patrols shall not be run unless there is a supply of oil for the pump to draw from. A good grade of hydraulic oil should be used.

Mechanical lifts are to be repaired or tightened immediately whenever wear is appreciable.

4.33 (a) **GENERAL.** The air cleaner
Tractor shall be cleaned when necessary, so
Operation that it is operating efficiently at all
times. The oil filter shall be serviced
or cleaned whenever needed.

The oil shall be changed as often as required. This is controlled by the conditions under which the tractor is operating.

All gear cases shall be filled to the proper level with the grade of lubricant required. The grade of lubricant must be changed according to the season of the year.

No tractor shall be operated when cylinders are not working properly.

Avoid starting the tractor with a jerk. Make the tractor take the load gradually; it will save gears and tires or tracks.

(b) **WHEEL TYPE.** Watch the front wheel alignment and do not allow the rear wheels to spin.

(c) **CRAWLER TYPE.** The tracks must be kept at the proper tension. Track joints or other moving parts, subjected to contact with dirt, etc., must be kept free from oil or grease.

The tractor shall be gone over each morning prior to beginning operation, giving special attention to the tracks and the track operating mechanism. Repairs for this type of equipment are expensive.

In the field, every effort should be made to secure the most capable and experienced operators obtainable.

4.34 (a) **"V" & ONE-WAY.** The push
Snow Plows plows, both "V" and One-way type, are very severe strains on truck equipment. Every precaution shall be taken to eliminate possible breakage.

It is desirable to have speed with this type plow, but the truck must always be operated at such a speed that the driver has complete control.

Repairs to the plow or plow mounting should not be neglected, but shall be taken care of at once.

A very appreciable saving in cost of shoes can be effected if old grader blades are worked over to fit the runners on snow plows.

Grader blades may be fitted to snow plows in place of ordering the regular snow plow blade, by use of a cutting torch in cutting the grader blade and in punching the moldboard of the snow plow to fit the State Highway punching of the grader blades.

(b). **ROTARY.** The rotary snow plows are not to be used to remove snow by pushing it. The truck shall be operated at a speed that will keep the rotors full of snow. By crowding a rotary snow plow, undue strain is placed on the working parts and often the amount of work accomplished is cut down.

(c). All truck units used with snow plow equipment should be provided with warm storage if possible. However in some localities in the State this is impossible. In such cases extreme care should be taken in starting the truck, warming the motor with hot air from a torch directed on the crank case previous to turning the motor over. This may be done without any

danger from fire by using several lengths of stove pipe to convey the heated air from the torch to the crank case. When you have the motor started, let it warm up thoroughly before starting to work with it.

4.35

Crushers

All crushers shall be operated at, or slightly higher than, their rated speed.

In feeding crushers, the best results will be secured if no material smaller than the desired size is permitted to enter the crusher, as it has a tendency to pack and places a severe strain on the working parts. Place grizzly bars ahead of the crusher to eliminate fine material, if the pit runs any appreciable amount.

(a). JAW. There is very little that can go wrong on jaw crushers if the bearings on the main shaft and the eccentric are kept adjusted and well lubricated. In operation, these units must be oiled and greased regularly.

(b). GYRATORY. On gyratory crushers, it is very necessary that the bolts around the frame be kept tight, so that there is no movement. The oil tank should be at least three-quarters full of oil at all times. The tank should be cleaned when necessary and new oil put in. Regular inspection shall be made to be sure oil pump is working.

4.36

Boilers and Retorts

Very specific instructions are given operators before starting work on a boiler or retort. These instructions vary according to the particular equip-

ment and to the location in which the boiler is to be used, and therefore, only a few general instructions are herein mentioned. The boiler must be kept clean, and only the best water obtainable shall be used. When necessary, boiler compound shall be used. Flues shall be cleaned as often as necessary and scraped at least twice every day. Retorts or pumps shall not be "high-balled" and the coils and pump shall be well drained and cleaned before moving or storing. Both boilers and retorts are mounted on trailers and must not be towed at an excessive speed.

4.37

Safety

Instructions for Operators

1. Be courteous at all times.
2. Be neat about your personal appearance.
3. Regulate the speed of your equipment according to road

and weather conditions.

4. Slow down at road intersections.
5. Do not pass the vehicle ahead on curves, grades or hills.
6. Do not follow the vehicle ahead too closely.
7. Stay in line when the traffic is heavy.
8. Stay on the right side of the road when on the way to and from work.
9. Do not stop on the roadway.
10. Do not move against traffic unless the nature of the work makes it unavoidable.
11. Place a torch to the rear and in front of equipment if stalled at night.
12. Place a flag to the rear and in front of equipment if stalled in daylight on the roadway.
13. Before backing, be sure nothing is behind you.
14. Do not make sudden stops.
15. When making left turn give on-coming traffic sufficient warning.
16. Use caution when children are on the road.
17. Protect equipment at all times with the necessary flags and reflectors.
18. Protect all towed equipment with a tow chain in addition to regular hitch, and display a red flag (18 inches square) on the front end of the towing unit and the rear end of the towed unit. Flags are to be placed on the left side.
19. Do not tow heavy trailers loaded with rollers, tractors or any other heavy equipment at a rate of speed over 12 miles per hour. When found advisable on a heavy trailer an extra man should accompany the unit to take care of handling the brakes on the trailer.
20. When working or moving a fleet of equipment each unit should be at least 300 feet from the next unit ahead in order to allow room for passing of traffic going the same direction you are traveling.
21. The state law relative to the operation of motor vehicles must at all times be strictly obeyed.

CHAPTER V

SURFACE MAINTENANCE

1. GENERAL

5.1 Methods Maintenance methods must be varied according to the surface types, class of material, and volume and class of traffic. However the following items are more or less common to all types of surface and must be closely followed.

5.2 Sanding of Icy Surfaces and Snow Removal (a). **SANDING.** Wherever a traffic hazard exists due to ice, frost, or moisture on smooth pavements or oiled sections, provision shall be made for storing dry sand prior to the winter and such sections when dangerous shall be sanded, using a rotary sander attached to a truck, or if necessary by hand methods. When using a rotary sander it should be adjusted so that the entire roadway will be sanded in one operation. In some instances it may be found advisable to add calcium chloride to the sand to increase its penetration when applied to icy surfaces and to prevent the sand from becoming frozen while in the stock pile. Under no circumstances shall calcium chloride be used in excess of 20% by volume, as an excessive amount has a detrimental effect on oiled surfaces.

(b). **SNOW REMOVAL.** It is the general policy to remove snow from the regular traveled routes except in high mountain passes and light traffic roads which neither justify the hazard nor the expense.

Snow removal operations should start with the storm or as soon as the fall is of sufficient depth for the equipment to remove it, and should continue until the road is clear at the end of the storm. Arrangements shall be made for relief crews so that no crew shall work more than eight hours per day.

During snow removal operations, extra precautions must be taken when passing or being overtaken by traffic to avoid throwing frozen chunks of snow through

windshields or dangerously obscuring the vision of other drivers. The speed of the snow plows must be reduced even to the point of stopping if such is necessary for the safety of traffic. A sudden swerving of snow plow equipment when striking hard, frozen masses of snow has frequently caused collisions with vehicles, and equipment operators must exercise increased vigilance under such conditions. All snow removal equipment shall be amply supplied with small tools, such as tow chains, shovels, picks, bars, jacks, etc.

Operators of snow units should give especial attention to motorists during storm periods. Cars stalled in drifts and ditches should be towed out. In extreme conditions towing service should be rendered. After a storm is over and the road is passable to traffic, additional work must be performed in the way of widening and removing snow from shoulders. As a preventive measure, in territory where drifting is prevalent, precautions must be taken in removing piles of snow that might tend toward blocking the road by forming drifts.

5.3

Drainage

All ditches and culverts shall be kept clean at all times. To prevent the accumulation of a large volume of runoff water which might cause excessive wash or scour, side ditches or drains shall be blocked to confine water wherever cross drainage is provided. On all heavy snow sections during the spring break-up, drainage shall be opened to prevent damage to the road surface. On heavy grades or high fills, constructed of disintegrated granite or material subject to wash, gutters must be constructed of timber or metal with necessary chutes to convey flow beyond toe of slope.

5.4

Cross Roads

Where cross roads intersect the roadway the intersection shall be maintained to the right-of-way lines on both sides and changed to the existing surface of the main highway. Where necessary to prevent rutting and the accumulation of mud on the road surface it shall be surfaced with gravel. In all cases, road approaches or crossings will be as low as the shoulder of the highway which they join or cross. Cross drainage will be maintained on all road approaches when necessary or advisable.

5.5 Slides and Washouts Slides and washouts must be immediately repaired, removed, or barricaded, and the proper danger signs, flags, and lights erected and maintained a sufficient distance on each side of the slide or washout to allow ample time for traffic to stop before arriving at the danger point. All warning signs, etc., shall be removed when repairs have been completed. All slide material, as far as practical, shall be utilized in widening adjacent fills or repairing washouts in the immediate vicinity.

5.6 Shoulders All shoulders must be maintained to full width and regular alignment. Keep all material off of paved or oiled sections. The shoulder material shall be flush at all times with the edges of the improved surface of the road and sloped to the outside at a rate of $\frac{3}{4}$ " to the foot to facilitate road surface drainage.

5.7 Oversize Large rocks which may cause damage to passing traffic by collision or high centering shall be immediately removed. All other oversize rocks, larger than the original surfacing material must be raked or forked off the roadway when blading operation have been completed.

5.8 Windrowing Material When it is necessary or practicable to tear up the surface of the roadway, the material must be windrown on the shoulders of the road with completion of work for the day, never in the center. If necessary for protection of traffic, bombshells and flags shall be used as warnings on both ends of windrow and all breaks in windrow.

5.9 Bridge Approaches All bridge approaches must be kept in such condition that no bumps or jump-offs will occur at the point which connects the grade with the bridge proper.

5.10 Railroad Crossings On sections which cross railroad tracks at grade, extra care must be taken to insure that no loose gravel, earth or other material is bladed or dragged onto the track or left near the track in such manner that it might get on the track under traffic.

Derailements resulting in death and great property damage have been caused by this negligence, and, therefore, this precaution must be given special attention. Extra precautions must be taken to avoid getting any of the road material wedged in openings between the inside of the rail and the crossing planks. Should any material be bladed into this opening it should be immediately removed.

5.11 All projecting blades or moldboard of
Protecting graders, drags, or maintainers when
Equipment and in use on the road surface or extending
Men out over it must display a red
flag not less than 18 inches square.

All maintenance operations requiring hand labor or the concentration of equipment on the roadway shall be protected at both ends at all times by the proper signs, flags, flagmen or lights as the occasion demands. Such warnings shall be removed immediately upon ceasing operations.

2. SURFACE TYPES AND THEIR MAINTENANCE

5.12 An earth road shall be shaped to
Earth Roads cross section in early spring and late
fall with a blade grader at which time
the moisture content is most favorable for such work.
The surface shall be crowned to assist drainage, but
never shall this crown be in excess of a rate of $\frac{1}{2}$ " to
the foot.

All curves must be super-elevated and compacted. The amount of super shall depend on the degree of curvature and will increase in proportion as the degree of curvature increases. The maximum super shall be obtained at the P. C. and P. T. of the curve and this super shall be carried throughout the length of the curve. The run-off from the super at both ends of the curve shall continue into the tangents on the ends of the curve for a distance varying from 150 lin. feet to 300 lin. feet before returning to the standard crowned section, providing the alignment of the road will permit. Division Engineers, being best fitted from practical experience and knowledge of local conditions to furnish such information, shall instruct maintenance employees as to super-elevation to be used on various curves within their respective Divisions.

Earth roads during the operating season shall be bladed during or as soon after storms as the material will permit. Blading operations must be continued until the material is thoroughly compacted. When blading operations on an earth road are in progress, do not open up more work than can be completed during the day so that the road may be safe for traffic during the night. A ridge of material must never be left on the traveled roadway.

5.13

Crushed Gravel or Rock Surfaces

Every effort shall be made to maintain all crushed gravel or rock surfaces in a well shaped, smooth, compact condition. When in this condition, surfaces of this nature best resist the effects of weather and traffic.

These results can best be obtained by starting intensive maintenance as soon after the spring breakup as road conditions will permit. Advantage should be taken of the moisture present in the road materials to insure thorough compaction of the surface. In order that gravel or rock surfaces may be given the maximum attention in the spring, all ditch cleaning and slide removal work shall be completed in the late fall before the freeze-up.

Gravel or rock surfaces should be maintained with a crown of $\frac{1}{4}$ " to the foot. Curves shall be super-elevated in accordance with instructions set forth under "Earth Roads". Advantage must be taken of every rain during the maintenance season by continuous blading of the material while it is wet. Excessive loose and inert surface material shall be bladed to the shoulders well beyond the traveled portion of the roadway. Care must be taken to see that this material is not lost over the shoulders of the road.

On sections which are well compacted, and on which only an occasional hole or depression occurs, patching with wet stock pile material containing sufficient binder gives excellent results providing the holes are cut to a square or rectangular shape with vertical sides and to the maximum depth of the hole. All dry and loose material should be removed before back-filling. Weak places in the surfacing, and large depressions which hold water shall be reinforced or filled with stock pile material. An excessive amount of material should not be used as it may cause a hump on the surface and destroy the riding qualities of the roadway.

When it is necessary to use binder material to set up a gravel or rock surface, it must be thoroughly mixed with the aggregate before final shaping, spreading, and compacting. Binder shall not be used on projects surfaced under oiling specifications without consent of the Testing Engineer, and the amount and character of the material as set forth by him shall be strictly adhered to.

5.14

Oiled Surfaces

All depressions that trap water on oiled sections should be noted and carefully marked during or immediately after a rain, while they are clearly outlined by the water standing in them. These depressions should be brought to true grade and section as early as possible by patching with either pre-mixed material or with a skin patch using RC-1 asphaltic binder and crushed gravel graded $\frac{3}{4}$ " to dust. This asphaltic material RC-1 is of a highly volatile nature and should be used in all maintenance sealing, repairing, and mixing, without heating. However, if weather conditions are such that heating must be resorted to, extreme care should be taken to prevent heating to above 80 degrees F.

The method to be used in patching shall be governed by the shape, size, and depth of the depression. Where a depression or a series of depressions are less than an inch in depth, the skin patch is preferable. In making a skin patch, care must be taken before applying the asphaltic material to see that the surface is dry, well cleaned and free from loose material, especially dust. After the surface has been cleaned, an application of RC-1 cutback asphalt, applied at the rate of from 1/8 to 1/4 gallon per square yard, should be followed with a covering of $\frac{3}{4}$ " crushed gravel. Should this application of oil and gravel not be of sufficient thickness to fill the depressions to the required height, other laminations should be built up by the same method. A few hours should be allowed to lapse to permit the curing of the asphaltic material. Care should be taken not to use an excessive amount of asphaltic material in any patching operation, an excessive amount of asphaltic material will not permit the forming of a bond with the mineral aggregate and will delay the curing action and will result in a displacement by traffic.

In making a patch with pre-mixed material, the depression shall be cut to a square or rectangular shape with vertical sides, and to a uniform depth, depending

on the maximum depth of the depression. The exposed surface shall then be coated with a light painting of RC-1 cutback asphalt before placing the pre-mixed material in the depression. The pre-mixed material shall be well tamped and brought flush with the adjoining surface. Where stock piles of satisfactory pre-mixed materials are available, this material should be used in patching, but where these do not exist some adequate means of hand mixing, such as a small mixing board should be used and the RC-1 asphaltic material and the mineral aggregate should be thoroughly mixed just prior to being placed in the depression.

Regardless of the nature of the asphaltic binder used in the pre-mixing, all patches should be sealed with an application of from 1/8 to 1/10 gallon of RC-1 cutback asphalt to prevent the entrance of moisture into the patched area.

Raveled edges and "chuck holes" in oiled surfaces shall be taken care of and repaired as outlined in the preceding discussion on filling depressions.

During the period required for patches, sealing, and new work to cure, oiled surfaces must be inspected at frequent intervals for signs of bleeding. The time required for curing will vary greatly as the nature of the oils used, climatic conditions, and the volume and type of traffic will have their influence. Under certain conditions, especially where new penetration work has been completed late in the fall, the curing may take as long as six months or more.

Where bleeding occurs, the surface shall be covered with a coating of coarse, clean, sand or screenings by means of a mechanical spreader or by hand spreading. Do not blade cover material from shoulders. These sections shall be inspected at regular intervals and shall be given special attention during hot weather and after rains.

Corrugating or wrinkling of oiled surfaces in most cases can be traced to the presence of water or moisture in the surface material or in the base. However, it is sometimes caused by an excessive amount of oil or the placing of the oiled surface on a loose or dusty base. All such undulations, if not extensive, shall be scarified to the bottom of the mat, and the oiled material windrowed on the shoulders by blade graders with the regular maintenance forces. If the trouble is due to water, sufficient time shall be allowed for the drying of the

base and the windrowed material shall be re-mixed until dry before replacing the mat. If after drying it is found that the addition of oil will be necessary, RC-1 cutback asphalt shall be used. If the condition has been caused by excessive oil, sufficient uncoated material similar to that used in the mat shall be added to the windrow and thoroughly mixed before replacing the mat. If a loose base is responsible for the corrugations, it shall be bound up and compacted before replacing the mat. If the corrugations are of such an extent that the repair of them will necessitate the concentration of equipment other than the regular maintenance machines, the work must not be undertaken before the Division Engineer is consulted or the matter referred to Headquarters. In all cases where the mat is torn up, it is imperative that it be thoroughly pulverized and mixed before respreading and reshaping.

When an oil mixed surface starts to ravel, it is caused by insufficient oil or poorly graded aggregate that lacks sufficient fines, especially those fines passing a ten mesh screen, or a combination of the two conditions. This ravelling may be corrected by tearing up the mat and adding oil or by adding oil and fine material with the qualities desired if obtainable. The mat must be thoroughly remixed before spreading. After it has compacted, which should require a period of from ten days to two weeks, under average conditions, the remixed section should be sealed with an application of from 1/12 to 1/10 gallon of RC-1 cutback asphalt. Due to the character of this asphaltic material, in that it cures or hardens very rapidly, it is not necessary to resort to the use of cover or blotter material in seal coating.

(If in some sections the surface of any oiled section becomes open or cracking or checking, it shall be seal coated with an application of from 1/12 to 1/10 gallon of RC-1 cutback asphalt.)

5.15 Oiled Stock Piles

For convenience and simplicity of mixing oil treated material to be used in connection with maintenance of oiled sections, a portable pug mill has been constructed. This pug mill will be moved from one Division to another during the summer season for operations as the need warrants. It will be under the direct charge of a foreman who is familiar with the operation of the machine. When it is moved into a

Division, the Division Engineer should take advantage of the opportunity and mix as much material as possible within the time allotted. All suitable mineral aggregate now in stock adjacent to oil treated sections shall be mixed with an asphaltic binder such as SC-3 or SC-4. Under no circumstances shall the asphaltic material used in mixing operation exceed 5% by weight of the dry mineral material. Great care must be taken in piling the treated material and in every case the piles should conform in every detail with the instructions set forth in the paragraph on "Stock Piles" of this manual.

5.16

Pavements

(a) Asphaltic concrete shall be patched in practically the same manner as set forth under oiled surfaces, except that the asphaltic binder should be the heaviest grade oil or cutback asphalt obtainable. The cutback is preferable. Bad riding qualities caused by corrugating can be greatly improved by skin patching with clean crushed rock or gravel and cutback asphalt. If the undulations are extensive a retread of clean, crushed, mineral aggregate and cutback asphalt shall be laid in much the same manner as road mix. Extensive repairs of any nature on this type pavement shall not be undertaken without consultation with the Division Engineer and Headquarters.

(b) Concrete. Repair all settlement, spall or buckles with asphaltic oil and rock or gravel. Thoroughly clean the surface by brooming. Apply light prime coat of asphaltic material making sure that the entire surface is coated, then cover immediately with pre-mixed material or finish with a wet patch as the need requires.

Keep all pavement cracks sealed with heavy asphaltic material. Get the asphalt in the crack, not over the pavement. Keep expansion joints filled with heavy asphaltic material and cover with coarse sand screenings which will pass a 1/8" screen.

Keep the shoulder material flush with pavement edges at all times. This applies to all types of pavement.

CHAPTER VI

MISCELLANEOUS MAINTENANCE

6.1 (A) TREES AND SHRUBS. Tree
Beautification watering cannot be done by sprinkling, it must be sub-irrigated by ditch or direct open hose. It is injurious to water trees sparingly several times a day. The water should be applied in such quantity that it soaks to the bottom root. This prevents the roots from seeking the top of the ground where the sprinkling system of irrigation places the water. Roots that lie near the surface are apt to winter kill by being frozen by early or late frosts. Watering should start sometime in May and continue until the first week in September or two to three weeks in advance of cold weather in order that the trees may have time to mature properly.

Care should be taken in watering evergreens so as not to sprinkle during the heat of the day, as water and sunshine together are very detrimental and will burn them.

The soil around the base of the tree should be kept loose, but not trenched, so that it will not bake in the hot sun. If possible a mulch of leaves or grass cuttings can be placed a few inches deep around it and will cut down the burden of continual watering to a great extent.

All pruning and cutting back of dead wood in the winter time will be done by one crew, this crew working under direct orders from Headquarters.

(B) GRASS. Watering of grass involves sprinkling methods, to get the water down several inches into the ground. Thorough soaking here again is necessary, although to a less extent than trees, of course. All sprinkling and watering shall be done as early in the day as possible during June, July and August.

Grass should not be cut too short, lawn mower blades should be set at about $1\frac{1}{2}$ " from the ground. During the extremely hot spells, let the grass go a little longer between cuttings. In ordinary weather in the summer, if the grass is cut often enough so that the cuttings are not too long, there is no need of raking.

The cuttings will not turn the lawn yellow unless they are too long. The grass around the trees should be kept trimmed, otherwise the project looks very ragged.

6.2 Strength of dynamite is rated according to the percentage of nitro-glycerin contained. In dynamite, one stick of 40% equals 1.4 sticks of 20% or 0.78 stick of 60%. In requisitioning dynamite specify strength, size, length and whether required for wet work.

Use 20% for blasting stumps and moving other than rock yardage. Use 40% and 60% for mud capping boulders and moving rock yardage. Before shooting have flagmen with red flags stop all traffic a safe distance from the explosion.

Do not store caps and exploders with other explosives. Permit must be secured from the local forest ranger before any blasting is done in National Forest areas during the fire season.

6.3 All important structures must be inspected by the Division Engineer twice each year, prior to and following the winter season. The Resident Engineer or Maintenance Superintendent shall inspect all structures in his territory at least once every three months and the Maintenance Foreman or patrolman shall inspect all structures in his territory at least once every month. Serious defects which endanger traffic or the structure itself shall be reported immediately to the Division Office which in turn shall advise Headquarters if necessary. Periodic inspection of important structures will be made by a representative of Headquarters office. The following outlines the items to be considered:

1. Condition of approaches (surface, shoulders and slopes).
2. Condition of asphaltic wearing surface or of planking if a timber floor. Note excessive wear or undue vibration.
3. Condition of guard rails and wheel guards.
4. Looseness or undue vibration of steel or timber truss members.
5. Condition of paint.
6. Cracked or broken stringers.
7. Crushed bearings or decayed timbers.
8. Broken chord members, sheared splices, etc.

9. Condition of slide plates, rockers or expansion joints.
10. Condition of piers or abutments.
11. See if clearing of channel is required.
12. Note erosion or washouts.
13. Note and correct any fire hazard.
14. Note any other items needing immediate or early attention.

6.4 Buildings and Camps All buildings, shops, garages, and camps must be kept orderly and sanitary, and precautions must be taken to guard against fire. In case buildings or camps are within the limits of the National Forest, rules in regard to fire and sanitation must be strictly adhered to.

6.5 Culverts All culverts shall be constructed in accordance with state standard specifications. Keep them clean at all times. Place cobble-stone bottoms at inlets and outlets, if scour occurs, grout them if necessary. Straighten and clean the channel at the outlet. If necessary construct a wall or dike to direct water through the culverts. Clean inlets and outlets of all culverts prior to winter and spring breakups, and as often as may be necessary at other times.

6.6 Detours Detours must be marked at each end by a standard "DETOUR—400 FEET AHEAD" caution sign, supplemented by a red flag and standard "ROAD CLOSED" barricade illuminated at night by red flashers or lanterns. All intersection roads on the detour shall be marked by standard detour signs. The foreman in charge should inspect the detour daily to make sure that all signs and markers are in their proper places.

6.7 Drainage All ditches shall be carefully inspected by the Resident Engineer or Maintenance Superintendent in the late fall and early spring before the break-up, and any accumulation of slides, weeds, and other debris shall be promptly removed.

All surface water which accumulates on the roadway shall be promptly drained into ditches and the necessary action taken to prevent a repetition. All obstructions in the channels of streams adjacent to high-

way embankments which cause scour or wash that would tend to endanger the roadbed shall be removed when the opportunity presents itself. Any reinforcement necessary to prevent the wash and scour of highway embankments which are in close proximity or parallel to a stream shall be made of dry rock paving, cement rubble masonry, timber cribbing, or by other satisfactory means. All irrigation structures in use, particularly inverted syphons, shall be frequently inspected for leaks and for weakened inlet or outlet embankments.

6.8

Fences

(a) **RIGHT OF WAY.** No encroachment on highway right-of-way by adjacent property owners will be allowed, and any attempt to do so must be immediately stopped by the Resident Engineer or Maintenance Superintendent and the Division Office notified.

All highway encroachments upon railroad property that are covered by leases or agreements which stipulate that the Highway Commission shall maintain right-of-way fences are interpreted to mean only those sections of fence opposite or adjacent to sections that are kept in good repair by the Railroad Company. The sections of railway fence for which the state is responsible shall only be maintained to the same standard as the opposite or adjacent fence.

All State employees shall be watchful for dead animals upon the railway right-of-way in the proximity of highway encroachments. When a dead animal is found in such a location the employee shall ascertain if possible where the animal entered the right-of-way and should there be any possibility of attaching any blame for the accident to the Highway Commission, a written report, giving full details, shall be submitted to Headquarters through the Division Office.

Each Division Engineer shall familiarize himself and his responsible employees with the locations and obligations attached to all highway encroachments upon railroad or other private or public property within his Division. This must be rigidly carried out in order that the expense incidental to such obligations may be held to a minimum.

(b) **SNOW FENCE.** Where possible on sections subject to drifting, snow fences should be erected to prevent the forming of drifts on the traveled roadway. Only by careful study of the local topography and of

the prevailing wind can snow fences be erected so they will offer a maximum protection with a minimum outlay. The needs can best be determined by observation of conditions as they actually exist in the field during severe storm periods. The erection of a snow fence shall be according to the details shown on blue print for "Wood Slat Snow Fence" which will be furnished upon request.

(c) **SNOW FENCE BRANDING.** All snow fences should be marked according to the following instructions: A strip four inches wide, three feet long, approximately eight inches from top, in the middle of each fifty or hundred foot section. Our regular Flex paint (Highway Red) should be used for this marker.

In most localities which are subject to high winds, it will be found advisable to remove the snow fence during the season when it can be of no benefit as the vibration greatly shortens the life of the fence by breaking the wires that hold the slats in place causing considerable unnecessary repair work. Also when left standing, it is subjected to the depredations of livestock. When the snow fence is taken down, it must be stored where it will be safe from fire, theft and other acts of vandalism.

6.9

Frost Boils

Frost boils occur in all types of surfaces, subjected to long severe cold spells, where there is an excessive accumulation of water in the sub-grade. The character and composition of the material used or present in the roadway is probably the controlling factor in the collection and retention of water although volume and type of traffic is the detrimental contributing factor which determines the amount of the damage to the road surface. Due to the diversified nature of the contributing factor, each individual frost boil presents its own problem which can be solved only by a concentrated study of the local conditions and topography. Therefore, no effort will be made to establish a criterion which could be universally adopted, but the installation of trench drains, tile or perforated culverts have proven adequate in many instances for the correction of the trouble. No extensive operation for the amelioration of frost trouble shall be undertaken without the consent of the Division Engineer. Any undulation or other hazards caused by frost action which jeopardizes the safety of the traffic shall be amply protected both day and night by the proper signs and signals until the hazardous condition has passed or been corrected.

6.10 Guard Rail All guard rail shall be constructed in accordance with the standard specifications and must be inspected at frequent intervals for dry rot and other defects which tend to weaken and decrease its value as a safety factor to the traveling public. All broken or damaged guard rail shall be repaired immediately and at all times it should be kept true to line and grade and well painted. Do not apply paint to a damp surface, nor during rainy, foggy or freezing weather. Remove all paint scale with a stiff wire brush. Thin paint with linseed oil, not turpentine or gasoline. In case of the cable type, turn buckles should not be loosened during the winter months to allow for contraction as a loose cable greatly impairs the efficiency of the guard rail.

6.11 Mail Boxes Mail boxes should be kept off of guard fences and structures. Wherever possible have mail boxes placed where the carriers car will not be stopped on the surfaced portion of the highway. In some cases it may be found necessary to do a small amount of shoulder widening and surfacing to accomplish this safety measure. All mail boxes shall be erected and maintained by their respective owners in such a manner that they will not be unsightly.

6.12 New Road Approaches The installation of all new road approaches after the completion of the highway must be approved by the Division Engineer and built under his supervision. The Division Engineer will determine the size of the drainage pipe under the approach. It must be of metal or reinforced concrete. No wooden boxes will be allowed.

All costs in connection with the installation, including the culvert, must be paid by the party desiring the approach. It is desirous to have road approaches surfaced with crushed rock or gravel to the right-of-way fence. This will tend to prevent vehicles, entering the highway, from damaging the edge of the surfacing and will eliminate to some degree the depositing of undesirable material upon the traveled section.

6.13 Roadside Fountains Where drinking fountains have been erected on state highway right-of-way and their location and design have been approved, the sites shall be maintained in a neat and orderly condition by the regu-

lar maintenance employee. Particular attention shall be paid to eliminate the possible contamination of the water supply. Suitable signs shall be erected and maintained, notifying the public as to the location of the fountain and as to whether or not the water is to be used for drinking purposes. Sites of this nature suitable for future development should be investigated and reported to Headquarters accompanied by a proposed design of the structure to be erected and an estimate of the cost to be incurred.

6.14 Rubbish Any person or persons dumping or leaving upon any highway, highway right-of-way, or within 200 yards of such public highway, any garbage, rubbish, or dead animals are violating the state law. Such violations shall be reported by the Resident Engineer or Maintenance Superintendent to the local authorities with the request that action be taken against the offenders.

6.15 Service Stations New service stations built adjacent to the highway must be so located that none of the construction will encroach upon the highway right-of-way and the approaches to and from the stations shall not obstruct the side drainage. Also they must be constructed so that cars when stopped for servicing will not be upon highway right-of-way. If necessary to install culverts under the approaches, the installation shall conform in every respect to the regulation set forth under paragraph 6.5.

6.16 Sight Clearing At all points along the highway where the sight distance may be materially increased and the traffic hazard decreased by clearing away timber growth on adjacent property, an effort shall be made to obtain permission from the property owner to do so. In clearings of this nature all scrub or small growth shall be cleared to the surface of the ground. Should the growth consist of or be interspersed with trees having a diameter of five inches or greater, an effort should be made to obtain the sight distance desired by trimming rather than cutting them down. Slashing from clearings of this nature shall be piled and burned when the opportunity presents itself.

6.17 Center-Line Painting Paint crews will be organized at Headquarters and sent to the different Divisions, and while there they will be under orders of the Division En-

gineer. The division shall provide a truck to haul supplies so that no delay will be encountered at any time.

A stripe three inches in width will be painted on roads carrying more than 300 cars per day or less and four inches in width on roads carrying more than 300 cars. It will not be necessary to mark the roadway first, but care shall be taken so that the stripe is laid straight on all tangents. The center line stripe is to be continuous on all curves with a sight distance of less than 300 feet. On all other curves and tangents the stripe will be approximately 1:2; for example, 35 feet painted and 70 feet unpainted.

6.13 All advertising, guide, warning and
Signs political signs which are erected or placed on highway right-of-way are unlawful and shall be removed immediately, except those giving distance to telephone service, standard warning, directional and route signs placed by the Highway Commission, or those placed under authorization. This also applies to signs attached to fences bordering the highway or on telephone, telegraph, or power line poles. Any controversy arising from the removal of unlawfully placed signs shall be reported to Headquarters through the Division office.

All signs and signals shall be placed and maintained by our regular forces. Section men are required to keep signs in good condition and replace any that are beyond repair. Permanent signs are not to be removed during blading operation without the permission of the Resident Engineer or Maintenance Superintendent. These signs are placed in a certain position with the highway and continual removal nullifies the care with which they were first installed.

The shape and color combination of signs each have their own significance. The octagonal sign is used to indicate a stop. The diamond shaped signs are used to indicate any condition inherent in the road itself, requiring slow speed or caution on the part of the driver. The circular sign is used as an advanced warning at railroad crossings only. The square shaped signs are used to indicate any condition requiring caution that is not inherent in the road itself but due to adjacent conditions such as schools, cross roads, etc. The rectangular shaped signs of various dimensions are used to carry directional information and restrictions of use or benefit to the driver. The shield shaped signs

are used only to mark U. S. highways. Signs having a black design on a yellow background mean caution or have your car under control. Red background signs mean immediate danger. All directions, information and restriction signs are black design on a white background, except that the "Rest Station" sign is white on a green background.

Before a newly constructed project is taken over for maintenance it is necessary that signs be erected for the protection of the traveling public. The "End of Pavement", "End of Gravel", "Slow", "Loose Gravel", "Sharp Curve" or "Blind Curve", etc, signs shall be placed prior to acceptance.

STOP SIGN. This sign is for use on a highway where traffic is required to stop and should be placed at farm approaches where the sight distance is poor, at the intersection of two main highways, and at the junction or intersection of a cross road with a main highway. That latter use of this sign will be the most common and will require the erection of the sign in a position to be visible and to warn traffic approaching the main route. The stop sign should not be set back in an effort to save the sign, but should be placed so the driver can see and understand the reason he has been brought to rest.

All precautionary or warning signs should be placed from 400 to 100 feet from point of danger, and all curve signs shall be placed a minimum of 400 feet from the actual beginning and ending of curve. Local topography often makes it necessary to vary this standard, but it should be followed as closely as possible. All signs shall be erected on shoulder line or as close to shoulder as possible; in general, the center of the sign should be three feet and six inches above the crown of the surfacing. In order to avoid a glare reflected back to the driver, all signs without illuminating arrows should be turned toward the road so that the glare of the sign will intersect the center-line of the roadbed at an angle of 45 degrees. All signs with illuminating arrows should be set at right angles so that the driver will be able to see the warning at the greatest distance.

The route markers should be placed at the same height and on the shoulder line as the warning signs, and one shall be erected at all main road intersections and wherever there is a chance of the traveling public to be misled. Do not place these signs directly opposite

each other as this has a tendency to make the road look much narrower than it really is. On all oiled sections, signs warning off tractors with lugs shall be placed at each end and at all important intersecting roads. These signs shall be placed at right angles to the main highway. Slow signs must be placed at the end of all graveled, oiled, or paved sections where there is a change to an earth section. "End of pavement" must be placed at the end of all oiled or paved sections. The large red letter "Slow" sign adopted by this organization are for use only in extremely dangerous places. Care should be taken to see these signs are properly placed and that they are not used unless a real hazard exists.

All warning and directional signs of a permanent nature, except route and highway markers, shall be attached to a surfaced square 4" x 4" wooden post which has been previously painted with three coats of outside white paint. All route and highway markers, except those erected within the limits of towns and cities, will be attached to a standard steel "U" shaped post. Route or highway markers erected within the limits of a town or city require a special setup which varies with local conditions. The necessary bolts, washers, nuts, and lag screws used for attaching a sign to the post shall be galvanized. Any sign that is damaged in any way shall be immediately repaired or replaced by the sectionman. Any sign or other warning signal of temporary nature shall be removed after the need is passed. All signs or signals used for the protection of traffic, state employees, or equipment during the day, such as "Men Working", must be removed at the end of the working day and never allowed to remain over night. Any person or persons defacing, damaging, or injuring any state highway guide, warning, or other sign, is guilty of a misdemeanor. All sectionmen must maintain a careful watch for any vandalism and report to his immediate superior any persons caught shooting or otherwise defacing state signs.

6.19 All stock piles of sand, crushed gravel, and oil treated material, shall be placed where possible, on state highway right-of-way or property and so located that they will not create a traffic hazard or cause snow drifts. The stock pile sites shall be free from rocks, brush, stumps, weeds, or any other obstruction or condition which might cause undue loss of material or interfere

in loading operation by means of a mechanical loader. The site shall be well drained, especially for oil treated material. The stock piles must be so constructed that the least possible surface area will be exposed to the elements and shall be free from water traps. It is essential that the stock piles be maintained in such a condition at all times that they will readily shed water. On all stock piles of considerable size, a sign stating "State Property Penalty for Theft State Highway Commission" shall be erected and maintained.

6.20

Tractors

The law states that tractors with lugs or cleats are not allowed on the highway. This should not be interpreted to apply to farmers who are cultivating land on both sides of the highway and who cross the highway occasionally at right angles to the center-line of the roadway. The use of planks for crossing purposes shall not be permitted, for without the proper precaution, they prove a distinct hazard to the traveling public.

6.21

Traffic Counts

State-wide traffic counts will be taken on the following days: The third Friday in June, third Saturday in July, third Wednesday in August, and third Thursday in September, and at places as may be designated by Headquarters special isolated counts may be taken for a particular purpose at the discretion of the Division Engineer. All charges of stations and all stations to be added shall be referred to Headquarters for approval. When a time is selected for a general count at all stations it must be taken regardless of weather conditions. Unless otherwise specified, counts will be taken for a four-hour period, from 2 to 6 P. M., which represents 32% of a 16-hour count taken from 7 A. M. to 11 P. M., and the count shall be reported in detail to the Headquarters as a 16-hour count. The traffic shall be segregated into the various capacities as set forth on the regular traffic census form. Light trucks will be considered as trucks of less than 1½ ton capacity. All vehicles passing each given point shall be counted regardless of the direction. Traffic counts which are taken at road or highway intersections should be three-way counts; that is, all roads leading from the intersection should be considered separate and independent roads, and the traffic tabulated in accordance; which means that each vehicle passing the intersection must be counted twice, once on the road leading to the intersection and once on the road leaving the intersection.

The detailed sheets shall be totaled and checked by the Division Office before forwarding and must reach Headquarters the first of each month following date of census. Any unusual condition which affects normal traffic shall be noted on the back of the sheets.

6.22

**Warning
Posts**

All hidden headwalls and similar hazards shall be marked by placing a warning post six inches square, painted white, and extending two feet and six inches in height above the shoulder of the road. All culverts and syphon headwalls, or any other structure or obstruction, which might be obscured during the winter by snow and which presents a hazard to snow removal equipment shall be marked by a suitable warning post, painted with outside white. The top of the warning post shall be two feet and six inches above the crown of the road. Warning posts 8" square or round posts 8" in diameter, 6' long and set 3' and 6" in the ground with 20' centers should be used on many of the less dangerous curves and fills instead of the standard guard fence. These posts shall be painted white, except the first 8" above the ground which shall be painted black.

6.23

**Walls-
Retaining**

All dry rock, cement rubble or concrete retaining walls, or timber crib work along highway embankments shall be regularly inspected as to their condition and need for repairs. Special attention should be paid to raveling of dry rock walls adjacent to railroad tracks, and to the weep holes in cement rubble masonry and concrete walls to see that they are unobstructed and functioning properly.

6.24

**Waste
Water**

When irrigation water is being diverted onto the highway right-of-way and it is endangering the roadway or safety of the traveling public, such condition shall be brought to the attention of the owner of the adjacent property or his responsible employee and request made of him or them that the flow of water be stopped. If the owner or his responsible employee does not take care of the water, the Division or District Office must be notified immediately so that they may take the proper action as outlined in the penal code on the control of waste irrigation water.

6.25**Weeds**

The right-of-way shall be kept free of tall grass, weeds, and brush at all times, and especial attention should be given to weed and brush, growing around guard fences, sign posts, bridges, and other structures. All weeds and brush shall be burned as fast as possible, taking care to see that private or state property is not damaged incidental to this operation. In territories where an effort is made by the ranchers to control weed growth, cutting of weeds shall be so done that the seed will be destroyed.

6.26**Standard
Forms****TRAFFIC CENSUS, FORM 61.**

When requested, standard traffic census forms are prepared in duplicate by designated field men, and submitted to the Division Office for checking. The original is then forwarded so that it will reach Headquarters by the first of each month following date of census.

SNOW REMOVAL REPORT. Weekly snow removal reports are prepared in triplicate by Resident Engineers or Maintenance Superintendents during the snow removal period. The first report shall cover all snow removal charges up to and including the first Saturday in November and the report shall be discontinued the last Saturday in March. The original copy shall be sent direct to Headquarters so that it will be received by Monday of each week. The duplicate copy is forwarded to the Division Office and triplicate is retained.

CRUSHER REPORT. Daily crusher reports are prepared in triplicate by the crusher foreman or timekeeper, the first report shall be made when crew has been organized and is on the move. The original shall be sent direct to Headquarters so that it will be received within three days, duplicate shall be sent to the Division Engineer and triplicate shall be retained.

WEEKLY AND MONTHLY BETTERMENT OR SPECIAL MAINTENANCE COST REPORT. A weekly report is to be prepared in duplicate on all Special and Betterment work which involves an expenditure of \$10,000.00 or over and a monthly report is to be prepared on all other Special and Betterment work. This report is to be prepared by the foreman or timekeeper. The original is to be mailed direct to Headquarters and the duplicate to the Division Office.

SHOVEL, REPORT. Daily shovel output reports are to be prepared in duplicate by the foreman or timekeeper. The original is to be mailed direct to Headquarters and duplicate to the Division Office. The information desired in these forms is quantities and actual cost of operating the shovel.

DAILY OIL REPORTS will be submitted on all Special and Betterment oiling orders unless advised to the contrary. Weekly Oil Reports will be submitted on oiling projects under contract. These reports must be filled in completely and should show whether the work is Penetration, Road Mix, or Plant Mix. The depth of the mat must be shown at the top of the report. If this varies, definite information must be shown in the "Remarks" column.

Under "Siding" the Timekeeper or Inspector should show the name of the siding where cars are being unloaded. In the "Oil on Hand" column the grade of oil, as well as the gallons, should be shown. After "Mile" at the top of the report you should show the name of the town which represents Mile 1, and then run the "Grade Prepared", "Oil Applied", "Mat in Place", "Rolling", "Seal Coat" and "Complete" arrows away from or to this point, so that we will know at all times how the work is progressing.

In the columns which show "Shipper of Oil" the grade of oil as well as the name of the company supplying the oil should be shown. In the "Grade Prepared" column it will be necessary to show exactly what portion of the project is being prepared. If preparation operations are being carried on in several different locations it will be necessary that the arrows so indicate instead of running them straight thru. On each of the columns so provided the arrows should indicate exactly what portion of each type of work is "Complete". As there is no "Tack Coat" column on these reports, when it is necessary this "Tack Coat" may be shown below the "Completed" column on the Daily Oil Report and below the "Seal Coat" column on the Weekly Oil Report.

When shipments are received it is necessary to show the car or truck number, date received, grade of oil, and net gallons, also the distribution if the car or truck has been unloaded. It is only necessary to show carload shipments of oil twice. That is, once when the car is received and once when it is released. When a car is

shown received on a certain project or maintenance section and is not shown further, it will be considered that the entire car will be used on the project or maintenance section it has been shown on. If after receipt of the car and after it has been shown on the report, it is found necessary to split it between two or more jobs, it will be necessary that the distribution be shown in the "Otherwise & Explain" column. If a car is split between two or more jobs the total received should be shown only on one report; then in the "Otherwise & Explain" column show the amount transferred to each project. On the projects the oil transferred to the Inspector or the Timekeeper should show in the "Otherwise & Explain" column "Received.....gallons from" (Giving the truck or car number and the project it was received from). When cars are released the gallonage should not be again shown but the mile or miles the oil was placed on should be shown.

To arrive at the "Oil on Hand" on each report the balances should be figured as follows: On Report No. 1 add all of the shipments of oil received and deduct the quantity shown on the road or otherwise disposed of. This will give us the oil on hand. On Report No. 2 and all further reports the car or truck loads of oil received during the week should be added to the "Oil on Hand" as shown on the previous report, and the gallonage used during the week deducted from this amount. To further balance the report, the oil in each mile, plus the oil on hand, plus the oil shown in the "Otherwise & Explain" column, should equal the amount of oil purchased. In the "Gallons of Oil" column the totals shown in each mile should be the totals to date and not the total applied each day or each week.

The total receipts for each day or week should be shown immediately below the last shipment received. A running total should be kept of the number of gallons received on the project. This total should be shown in the "Contents Net Gallons" column immediately below the last line. The running total should be the total number of gallons received, and the total of other distribution should be shown in the "Otherwise & Explain" column. This amount deducted from the running total should give the number of gallons applied to the project.

On plant mix projects the gallons of oil and the tons of mix in the stock pile should be shown in the "Remarks" column. The total oil and tons applied to the stock pile during each week should be shown separately

and the grand total carried over the entire project. The plant mix report should show the number of tons of material produced each week and should also show the total tons produced to date. It is not necessary to show the number of tons of plant mix material placed in each mile as this material should be of uniform thickness and approximately the same number of tons placed in each mile.

For the convenience of the fieldmen, as soon as a seven-mile section is entirely completed this may be dropped from the report. However, the final report should be complete in all respects and show the entire mileage. The original copy of all oil reports are to be sent direct to headquarters by the Timekeeper or Inspector in charge of the project, the duplicate to the Division office and the triplicate retained.

In ordering oil the first order should show the purchase order number and name of Inspector or Timekeeper and the postoffice address where shipping notices are to be sent. A copy of each order for oil must be sent to headquarters in duplicate, and the project number or maintenance section the oil is to be used on should be shown on the order. Each individual shipment of oil received on a project must be shown. On carload shipments the initials and number of the car should be shown and on truck shipments the license number of the truck should be shown and the capacity of each load.

The capacity of each load or tank car as shown on the reports must check with the gallonage shown on the chemist's acceptance certificates which cover each shipment of road oil. Before payment may be made for any oil it is necessary that the report of chemist's acceptance certificates, and invoice, check. The distribution on invoices covering oil purchased by this department must check with the distribution as shown on the reports. On oil purchased by this department it will be necessary that the pink copy of the chemist's acceptance certificate be sent in with the invoice. On shipments of oil purchased by contractors the pink copies of the chemist's acceptance certificate must be attached to the contractor's invoices, which are submitted to this office.

Road oils and cutbacks must be requisitioned in accordance with the instructions contained in the Schedule of Reports and Requisitions. It is absolutely necessary that no road oil or cutbacks be ordered unless covered by a purchase order.

Car Received Ticket, Form No. 116—To be used for gasoline, road oils and cutbacks.

Gasoline—As soon as car is received, a record is started, first by entering the car number, the contents, the date and time received and from whom received. When the car is unloaded the date and time of unloading and the temperature are entered in the total column. When the entire car has been unloaded, the meter reading, after unloading, is entered in total column. The difference before and after unloading is calculated. The form is then signed by party receiving and turned in to the district office.

Road Oil and Cutbacks—There will be no meter readings in unloading of road oils and cutbacks. The space for Liquid Gravity need not be filled in as this is for cutbacks only and is secured after being tested in the Laboratory. This form is to be made out in quadruplicate, the original to be attached to claim, duplicate to the Monthly Inventory, triplicate shall be sent to the Division Engineer, quadruplicate is to be given to the Resident Engineer.

Withdrawals from Inventory, Form No. 115—To be used when Gasoline or Road Oils are drawn from storage. The withdrawals from Inventory shall be entered as Gasoline or Road Oils are drawn. The meter reading shall be recorded before and after loading and the metered gallons computed. The meter readings are for gasoline only as road oils will not be metered. The actual gallons should be recorded when size of container is known. The driver of truck making delivery shall sign Inventory when withdrawals are made and insert delivery ticket number and gallons delivered on return to plant. The original is turned into District Office at the end of each week for checking and filing and duplicate shall be retained by the party in charge of storage.

Delivery Ticket, Form No. 114—To be used in delivery of Gasoline, Lubricating oils, road oils and Miscellaneous. This form should be signed by party making delivery and party receiving same. The original is to be sent the District Office, duplicate to the party receiving and triplicate is retained in the book.

Gasoline, Oil & Grease Distribution Sheet, Form No. 78—This form is to be used in the field, and all gasoline, oil and grease shall be recorded and charged out as it is used. The total gallons of gasoline, etc., received, total

charged out and total on hand should balance. At the end of each month this form shall be mailed to the District Office in order that the Monthly Inventory may be completed.

Monthly Stock Inventory, Form No. 79—The first part of each month a Monthly Stock Inventory shall be made out. This shall show the distribution for all charges and credit for store account. This form shall reach Headquarters not later than the tenth day of each month.

Paint Crew Report—Daily paint crew reports are prepared by the foreman, first report to be made out when crew has been organized and on the move. The original is to be sent direct to Headquarters so that it is received within three days, duplicate to Division Engineer and triplicate is retained.

Road Condition Report—A written report on the condition of all main highways shall reach Headquarters not later than Friday of each week, this report to be supplemented by telegraphic reports whenever needed.

Signing Report—Weekly signing reports are prepared in triplicate by the foreman, original to be sent so it will reach Headquarters by Tuesday of each week, duplicate to Division Engineer and triplicate retained. This report is made out by State signing crew only.

Inventories—Monthly stock inventory, Form No. 79, is prepared in quadruplicate at the end of each month by the Division or Resident Engineer where stores are kept. Original, duplicate, and triplicate are submitted to the Division Office for checking, quadruplicate is retained. Original and duplicate are then forwarded so as to reach Headquarters not later than the tenth of each month.

Equipment Inventory, Form No. 52-Revised—This form is prepared in triplicate by timekeeper or foreman and submitted to the Resident Engineer or Maintenance Superintendent. Original and duplicate are forwarded to Division Office for approval. Original is then submitted so as to reach Headquarters not later than the tenth of each month. This form is used only in connection with construction force account work.

Inventory of Equipment not on rental basis, Form No. 80—This form is prepared in duplicate at the close of the calendar month by the Resident Engineer or Maintenance Superintendent. The original is submitted to the Division Office for their files.

Inventory of Equipment, Form No. 28—Prepared by Division Office in duplicate at the close of each calendar month. The original is sent to Headquarters, to arrive not later than the tenth of each month.

Monthly Report of Men Employed on Highway Maintenance—This report is to be made up on form furnished by the Government. The original and duplicate are sent direct to Bureau of Public Roads at Portland, Oregon, triplicate to Headquarters and quadruplicate to Division Office.

Annual Inventory, Form No. 88—Prepared in duplicate by the Division Office at the end of each fiscal year. The original is sent to Headquarters, to arrive not later than the first day of June.

Transfer of Equipment, Form No. 89—Prepared by the Resident Engineer or Maintenance Superintendent, and mailed direct to Headquarters whenever a major piece of equipment is transferred from one district to another or division.

Unserviceable Equipment Report—Unserviceable Equipment report is prepared in triplicate at the Division Office; original and duplicate are sent to Headquarters. This form is used only when condemning a piece of major equipment.

Unserviceable Small Tools and Supplies Report—Unserviceable small tools and supplies report, Form No. 121, is for use when condemning or reporting lost tools, such as broken or worn out shovels, rakes, etc. If tools become broken or lost thru carelessness the party to whom the tools are charged will be held responsible.

Employees Daily Time Card—Employees daily time card, Form No. 83, is to be used by shop employees in making time reports, and is also to be used to check up on unsatisfactory work done by mechanics.

Shop Work Order Request—Shop work order request, Form No. 84, is to be used when leaving equipment in a shop for repair or overhaul. It assists in bringing work to the attention of the shop mechanic that might otherwise be overlooked.

Vehicles Inspection Report—Vehicles inspection report is to be used by the field mechanic on his periodical inspection trips and will assist him in bringing to his immediate superior's attention careless and undesirable operators on the equipment.

Car and Truck Specifications—Car and truck specifications form is to be used by the Division Office and their mechanics to keep a record on various pieces of equipment as they are overhauled.

Equipment Service Record—The equipment service record, Form No. 90, is to be used with each piece of motorized equipment. The operator of the equipment shall make the necessary entries as outlined on the form. When completed, the form shall be mailed or given to the Division or District Mechanic for his information and file.

**6.27
Schedule of
Reports and
Requisitions
General**

Road Oils—All road oils and cut-backs for use in general maintenance shall be requisitioned at least three weeks prior to the time they are needed. Requisitions shall be for lots of approximately 10,000 gallons wherever possible. If this amount is not needed lots of approximately 2500 gallons each can be ordered to be delivered by truck to any point in the state. A new requisition shall be submitted when additional quantities are required. The requisition shall show where the material is to be used, how it shall be shipped and if the material is to be in a heated condition when delivered. The Helena office will requisition road oils and cut-backs for Special Maintenance, Betterments, and Construction Force Account Projects.

Spark Plugs—To be ordered when needed, figuring a small supply on hand.

Equipment Transfer Report (Form No. 89)—To be reported immediately after transfer.

Accident Report, General and Livestock—These reports to be submitted as soon as possible after accident with newspaper clippings if available.

Personal Injury Report—To be submitted to the Industrial Accident Board immediately after accident.

Unserviceable Equipment Report—To be made out when condemning a piece of major equipment.

Unserviceable Small Tools and Supplies Report (Form No. 121)—To be made out when condemning small tools and supplies.

Daily Crusher Report—To reach Helena within three days.

Daily Paint Crew Report—To reach Helena within three days.

Daily Oil Report—To reach Helena within three days.

Weekly Road Condition Report—A written report shall reach Helena not later than Friday of each week. This report is to be supplemented by telegraphic reports whenever needed.

Weekly Signing Report—To reach Helena by Tuesday of each week.

Weekly Oil Report—To reach Helena by Tuesday of each week.

Weekly Snow Removal Report—To reach Helena by Monday of each week.

Monthly Stock Inventory (Form No. 79—Gasoline, Grader Blades)—To reach Helena by the tenth of each month.

Monthly Statement of Betterments and Special Maintenance—To reach Helena by the tenth of each month.

Payrolls—To reach Helena by the 20th of each month.

Monthly Report of Men Employed on Highway Maintenance (BPR Emp. Form No. 2)—To reach Helena by the 20th of each month.

Monthly Equipment Inventory (Form No. 52-Revised)—To be in Helena by the tenth of each month while work is in progress.

Monthly Equipment Inventory (Form No. 28)—To reach Helena by the tenth of each month.

Traffic Census—To reach Helena by the first of each month following date of census.

Carload Gasoline—Three weeks before needed.

January 1st.

Paints and Varnishes—Including all paints except traffic line.

Gasoline, Oils, Greases, Lubricants—For the period from April 15th to October 15th; this does not include carload purchases of gasoline.

Small Tools—Of all kinds. This requisition to be sent in on a form to be supplied by the Helena office.

Cutting Edges and Scarifier Teeth—Give full details of equipment teeth are to be used in.

Special Maintenance and Betterment Estimates—For Calendar Year.

January 15th.

Broom Fillers—Specify equipment number.

February 1st.

Road Signs, Posts and Fittings—To include oil cloth signs.

April 1st.

County Wage Scales.

Traffic Line Paint—For period from July 1st to January 1st.

General Maintenance Estimates—For fiscal year from July 1st to June 30th.

June 1st.

Rentals, Power, Gas, Light, Water.

Annual Inventory (Form No. 88).

June 15th.

Snow Removal Equipment.

Snow Fence Material.

July 1st.

Brake Lining.

Anti-Freeze.

Car Heaters and Radiator Shutters.

Shop Tools.

Gasoline, Oils, Greases, Lubricants—For the period from October 15th to April 15th.

August 15th.

Bureau of Public Roads Cost Study Reports.

October 1st.

List of Equipment to be Taken Off of Insurance.

November 1st.

List of Equipment to be Taken Off of Insurance.

Snow Removal Reports—Begin first report to cover all snow removal charges up to and including the first Saturday in November.

December 1st.

New Equipment—Requirements for the full calendar year, showing proposed assignment of present equipment.

Traffic Line Paint—For period from January 1st to July 1st.

Final List of Equipment to be Taken Off of Insurance.



30 DAY MONTH 30
TABLE OF AMOUNTS EARNED AT VARIOUS MONTHLY RATES

Days	Amounts Earned at Different Rates															Days	
	40.00	45.00	50.00	55.00	60.00	65.00	70.00	75.00	80.00	85.00	90.00	95.00	100.00	105.00	110.00		115.00
1	1.33	1.50	1.67	1.83	2.00	2.17	2.33	2.50	2.67	2.83	3.00	3.17	3.33	3.50	3.67	3.83	1
2	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00	5.33	5.67	6.00	6.33	6.67	7.00	7.33	7.67	2
3	4.00	4.50	5.00	5.50	6.00	6.50	7.00	7.50	8.00	8.50	9.00	9.50	10.00	10.50	11.00	11.50	3
4	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00	10.67	11.33	12.00	12.67	13.33	14.00	14.67	15.33	4
5	6.67	7.50	8.33	9.17	10.00	10.83	11.67	12.50	13.33	14.17	15.00	15.83	16.67	17.50	18.33	19.17	5
6	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00	6
7	9.33	10.50	11.67	12.83	14.00	15.17	16.33	17.50	18.67	19.83	21.00	22.17	23.33	24.50	25.67	26.83	7
8	10.67	12.00	13.33	14.67	16.00	17.33	18.67	20.00	21.33	22.67	24.00	25.33	26.67	28.00	29.33	30.67	8
9	12.00	13.50	15.00	16.50	18.00	19.50	21.00	22.50	24.00	25.50	27.00	28.50	30.00	31.50	33.00	34.50	9
10	13.33	15.00	16.67	18.33	20.00	21.67	23.33	25.00	26.67	28.33	30.00	31.67	33.33	35.00	36.67	38.33	10
11	14.67	16.50	18.33	20.17	22.00	23.83	25.67	27.50	29.33	31.17	33.00	34.83	36.67	38.50	40.33	42.17	11
12	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00	32.00	34.00	36.00	38.00	40.00	42.00	44.00	46.00	12
13	17.33	19.50	21.67	23.83	26.00	28.17	30.33	32.50	34.67	36.83	39.00	41.17	43.33	45.50	47.67	49.83	13
14	18.67	21.00	23.33	25.67	28.00	30.33	32.67	35.00	37.33	39.67	42.00	44.33	46.67	49.00	51.33	53.67	14
15	20.00	22.50	25.00	27.50	30.00	32.50	35.00	37.50	40.00	42.50	45.00	47.50	50.00	52.50	55.00	57.50	15
16	21.33	24.00	26.67	29.33	32.00	34.67	37.33	40.00	42.67	45.33	48.00	50.67	53.33	56.00	58.67	61.33	16
17	22.67	25.50	28.33	31.17	34.00	36.83	39.67	42.50	45.33	48.17	51.00	53.83	56.67	59.50	62.33	65.17	17
18	24.00	27.00	30.00	33.00	36.00	39.00	42.00	45.00	48.00	51.00	54.00	57.00	60.00	63.00	66.00	69.00	18
19	25.33	28.50	31.67	34.83	38.00	41.17	44.33	47.50	50.67	53.83	57.00	60.17	63.33	66.50	69.67	72.83	19
20	26.67	30.00	33.33	36.67	40.00	43.33	46.67	50.00	53.33	56.67	60.00	63.33	66.67	70.00	73.33	76.67	20
21	28.00	31.50	35.00	38.50	42.00	45.50	49.00	52.50	56.00	59.50	63.00	66.50	70.00	73.50	77.00	80.50	21
22	29.33	33.00	36.67	40.33	44.00	47.67	51.33	55.00	58.67	62.33	66.00	69.67	73.33	77.00	80.67	84.33	22
23	30.67	34.50	38.33	42.17	46.00	49.83	53.67	57.50	61.33	65.17	69.00	72.83	76.67	80.50	84.33	88.17	23
24	32.00	36.00	40.00	44.00	48.00	52.00	56.00	60.00	64.00	68.00	72.00	76.00	80.00	84.00	88.00	92.00	24
25	33.33	37.50	41.67	45.83	50.00	54.17	58.33	62.50	66.67	70.83	75.00	79.17	83.33	87.50	91.67	95.83	25
26	34.67	39.00	43.33	47.67	52.00	56.33	60.67	65.00	69.33	73.67	78.00	82.33	86.67	91.00	95.33	99.67	26
27	36.00	40.50	45.00	49.50	54.00	58.50	63.00	67.50	72.00	76.50	81.00	85.50	90.00	94.50	99.00	103.50	27
28	37.33	42.00	46.67	51.33	56.00	60.67	65.33	70.00	74.67	79.33	84.00	88.67	93.33	98.00	102.67	107.33	28
29	38.67	43.50	48.33	53.17	58.00	62.83	67.67	72.50	77.33	82.17	87.00	91.83	96.67	101.50	106.33	111.17	29
30	40.00	45.00	50.00	55.00	60.00	65.00	70.00	75.00	80.00	85.00	90.00	95.00	100.00	105.00	110.00	115.00	30

30 DAY MONTH 30
TABLE OF AMOUNTS EARNED AT VARIOUS MONTHLY RATES

Days	Amount Earned at Different Rates															Days
	120.00	125.00	130.00	135.00	140.00	145.00	150.00	155.00	160.00	165.00	170.00	175.00	180.00	185.00	190.00	
1	4.00	4.17	4.33	4.50	4.67	4.83	5.00	5.17	5.33	5.50	5.67	5.83	6.00	6.17	6.33	1
2	8.00	8.33	8.67	9.00	9.33	9.67	10.00	10.33	10.67	11.00	11.33	11.67	12.00	12.33	12.67	2
3	12.00	12.50	13.00	13.50	14.00	14.50	15.00	15.50	16.00	16.50	17.00	17.50	18.00	18.50	19.00	3
4	16.00	16.67	17.33	18.00	18.67	19.33	20.00	20.67	21.33	22.00	22.67	23.33	24.00	24.67	25.33	4
5	20.00	20.83	21.67	22.50	23.33	24.17	25.00	25.83	26.67	27.50	28.33	29.17	30.00	30.83	31.67	5
6	24.00	25.00	26.00	27.00	28.00	29.00	30.00	31.00	32.00	33.00	34.00	35.00	36.00	37.00	38.00	6
7	28.00	29.17	30.33	31.50	32.67	33.83	35.00	36.17	37.33	38.50	39.67	40.83	42.00	43.17	44.33	7
8	32.00	33.33	34.67	36.00	37.33	38.67	40.00	41.33	42.67	44.00	45.33	46.67	48.00	49.33	50.67	8
9	36.00	37.50	39.00	40.50	42.00	43.50	45.00	46.50	48.00	49.50	51.00	52.50	54.00	55.50	57.00	9
10	40.00	41.67	43.33	45.00	46.67	48.33	50.00	51.67	53.33	55.00	56.67	58.33	60.00	61.67	63.33	10
11	44.00	45.83	47.67	49.50	51.33	53.17	55.00	56.83	58.67	60.50	62.33	64.17	66.00	67.83	69.67	11
12	48.00	50.00	52.00	54.00	56.00	58.00	60.00	62.00	64.00	66.00	68.00	70.00	72.00	74.00	76.00	12
13	52.00	54.17	56.33	58.50	60.67	62.83	65.00	67.17	69.33	71.50	73.67	75.83	78.00	80.17	82.33	13
14	56.00	58.33	60.67	63.00	65.33	67.67	70.00	72.33	74.67	77.00	79.33	81.67	84.00	86.33	88.67	14
15	60.00	62.50	65.00	67.50	70.00	72.50	75.00	77.50	80.00	82.50	85.00	87.50	90.00	92.50	95.00	15
16	64.00	66.67	69.33	72.00	74.67	77.33	80.00	82.67	85.33	88.00	90.67	93.33	96.00	98.67	101.33	16
17	68.00	70.83	73.67	76.50	79.33	82.17	85.00	87.83	90.67	93.50	96.33	99.17	102.00	104.83	107.67	17
18	72.00	75.00	78.00	81.00	84.00	87.00	90.00	93.00	96.00	99.00	102.00	105.00	108.00	111.00	114.00	18
19	76.00	79.17	82.33	85.50	88.67	91.83	95.00	98.17	101.33	104.50	107.67	110.83	114.00	117.17	120.33	19
20	80.00	83.33	86.67	90.00	93.33	96.67	100.00	103.33	106.67	110.00	113.33	116.67	120.00	123.33	126.67	20
21	84.00	87.50	91.00	94.50	98.00	101.50	105.00	108.50	112.00	115.50	119.00	122.50	126.00	129.50	133.00	21
22	88.00	91.67	95.33	99.00	102.67	106.33	110.00	113.67	117.33	121.00	124.67	128.33	132.00	135.67	139.33	22
23	92.00	95.83	99.67	103.50	107.33	111.17	115.00	118.83	122.67	126.50	130.33	134.17	138.00	141.83	145.67	23
24	96.00	100.00	104.00	108.00	112.00	116.00	120.00	124.00	128.00	132.00	136.00	140.00	144.00	148.00	152.00	24
25	100.00	104.17	108.33	112.50	116.67	120.83	125.00	129.17	133.33	137.50	141.67	145.83	150.00	154.17	158.33	25
26	104.00	108.33	112.67	117.00	121.33	125.67	130.00	134.33	138.67	143.00	147.33	151.67	156.00	160.33	164.67	26
27	108.00	112.50	117.00	121.50	126.00	130.50	135.00	139.50	144.00	148.50	153.00	157.50	162.00	166.50	171.00	27
28	112.00	116.67	121.33	126.00	130.67	135.33	140.00	144.67	149.33	154.00	158.67	163.33	168.00	172.67	177.33	28
29	116.00	120.83	125.67	130.50	135.33	140.17	145.00	149.83	154.67	159.50	164.33	169.17	174.00	178.83	183.67	29
30	120.00	125.00	130.00	135.00	140.00	145.00	150.00	155.00	160.00	165.00	170.00	175.00	180.00	185.00	190.00	30

30 DAY MONTH 30
TABLE OF AMOUNTS EARNED AT VARIOUS MONTHLY RATES

Days	Amount Earned at Different Rates															Days
	195.00	200.00	205.00	210.00	215.00	220.00	225.00	230.00	235.00	240.00	245.00	250.00	275.00	300.00	325.00	
1	6.50	6.67	6.83	7.00	7.17	7.33	7.50	7.67	7.83	8.00	8.17	8.33	9.17	10.00	10.83	1
2	13.00	13.33	13.67	14.00	14.33	14.67	15.00	15.33	15.67	16.00	16.33	16.67	18.33	20.00	21.67	2
3	19.50	20.00	20.50	21.00	21.50	22.00	22.50	23.00	23.50	24.00	24.50	25.00	27.50	30.00	32.50	3
4	26.00	26.67	27.33	28.00	28.67	29.33	30.00	30.67	31.33	32.00	32.67	33.33	36.67	40.00	43.33	4
5	32.50	33.33	34.17	35.00	35.83	36.67	37.50	38.33	39.17	40.00	40.83	41.67	45.83	50.00	54.17	5
6	39.00	40.00	41.00	42.00	43.00	44.00	45.00	46.00	47.00	48.00	49.00	50.00	55.00	60.00	65.00	6
7	45.50	46.67	47.83	49.00	50.17	51.33	52.50	53.67	54.83	56.00	57.17	58.33	64.17	70.00	75.83	7
8	52.00	53.33	54.67	56.00	57.33	58.67	60.00	61.33	62.67	64.00	65.33	66.67	73.33	80.00	86.67	8
9	58.50	60.00	61.50	63.00	64.50	66.00	67.50	69.00	70.50	72.00	73.50	75.00	82.50	90.00	97.50	9
10	65.00	66.67	68.33	70.00	71.67	73.33	75.00	76.67	78.33	80.00	81.67	83.33	91.67	100.00	108.33	10
11	71.50	73.33	75.17	77.00	78.83	80.67	82.50	84.33	86.17	88.00	89.83	91.67	100.83	110.00	119.17	11
12	78.00	80.00	82.00	84.00	86.00	88.00	90.00	92.00	94.00	96.00	98.00	100.00	110.00	120.00	130.00	12
13	84.50	86.67	88.83	91.00	93.17	95.33	97.50	99.67	101.83	104.00	106.17	108.33	119.17	130.00	140.83	13
14	91.00	93.33	95.67	98.00	100.33	102.67	105.00	107.33	109.67	112.00	114.33	116.67	128.33	140.00	151.67	14
15	97.50	100.00	102.50	105.00	107.50	110.00	112.50	115.00	117.50	120.00	122.50	125.00	137.50	150.00	162.50	15
16	104.00	106.67	109.33	112.00	114.67	117.33	120.00	122.67	125.33	128.00	130.67	133.33	146.67	160.00	173.33	16
17	110.50	113.33	116.17	119.00	121.83	124.67	127.50	130.33	133.17	136.00	138.83	141.67	155.83	170.00	184.17	17
18	117.00	120.00	123.00	126.00	129.00	132.00	135.00	138.00	141.00	144.00	147.00	150.00	165.00	180.00	195.00	18
19	123.50	126.67	129.83	133.00	136.17	139.33	142.50	145.67	148.83	152.00	155.17	158.33	174.17	190.00	205.83	19
20	130.00	133.33	136.67	140.00	143.33	146.67	150.00	153.33	156.67	160.00	163.33	166.67	183.33	200.00	216.67	20
21	136.50	140.00	143.50	147.00	150.50	154.00	157.50	161.00	164.50	168.00	171.50	175.00	192.50	210.00	227.50	21
22	143.00	146.67	150.33	154.00	157.67	161.33	165.00	168.67	172.33	176.00	179.67	183.33	201.67	220.00	238.33	22
23	149.50	153.33	157.17	161.00	164.83	168.67	172.50	176.33	180.17	184.00	187.83	191.67	210.83	230.00	249.17	23
24	156.00	160.00	164.00	168.00	172.00	176.00	180.00	184.00	188.00	192.00	196.00	200.00	220.00	240.00	260.00	24
25	162.50	166.67	170.83	175.00	179.17	183.33	187.50	191.67	195.83	200.00	204.17	208.33	229.17	250.00	270.83	25
26	169.00	173.33	177.67	182.00	186.33	190.67	195.00	199.33	203.67	208.00	212.33	216.67	238.33	260.00	281.67	26
27	175.50	180.00	184.50	189.00	193.50	198.00	202.50	207.00	211.50	216.00	220.50	225.00	247.50	270.00	292.50	27
28	182.00	186.67	191.33	196.00	200.67	205.33	210.00	214.67	219.33	224.00	228.67	233.33	256.67	280.00	303.33	28
29	188.50	193.33	198.17	203.00	207.83	212.67	217.50	222.33	227.17	232.00	236.83	241.67	265.83	290.00	314.17	29
30	195.00	200.00	205.00	210.00	215.00	220.00	225.00	230.00	235.00	240.00	245.00	250.00	275.00	300.00	325.00	30

31 DAY MONTH 31
TABLE OF AMOUNTS EARNED AT VARIOUS MONTHLY RATES

Days	Amounts Earned at Different Rates																Days
	40.00	45.00	50.00	55.00	60.00	65.00	70.00	75.00	80.00	85.00	90.00	95.00	100.00	105.00	110.00	115.00	
1	1.29	1.45	1.61	1.77	1.94	2.10	2.26	2.42	2.58	2.74	2.90	3.06	3.23	3.39	3.55	3.71	1
2	2.58	2.90	3.23	3.55	3.87	4.19	4.52	4.84	5.16	5.48	5.81	6.13	6.45	6.77	7.10	7.42	2
3	3.87	4.35	4.84	5.32	5.81	6.29	6.77	7.26	7.74	8.23	8.71	9.19	9.68	10.16	10.65	11.13	3
4	5.16	5.81	6.45	7.10	7.74	8.39	9.03	9.68	10.32	10.97	11.61	12.26	12.90	13.55	14.19	14.84	4
5	6.45	7.26	8.06	8.87	9.68	10.48	11.29	12.10	12.90	13.71	14.52	15.32	16.13	16.94	17.74	18.55	5
6	7.74	8.71	9.68	10.65	11.61	12.58	13.55	14.52	15.48	16.45	17.42	18.39	19.35	20.32	21.29	22.26	6
7	9.03	10.16	11.29	12.42	13.55	14.68	15.81	16.94	18.06	19.19	20.32	21.45	22.58	23.71	24.84	25.97	7
8	10.32	11.61	12.90	14.19	15.48	16.77	18.06	19.35	20.65	21.94	23.23	24.52	25.81	27.10	28.39	29.68	8
9	11.61	13.06	14.52	15.97	17.42	18.87	20.32	21.77	23.23	24.68	26.13	27.58	29.03	30.48	31.94	33.39	9
10	12.90	14.52	16.13	17.74	19.35	20.97	22.58	24.19	25.81	27.42	29.03	30.65	32.26	33.87	35.48	37.10	10
11	14.19	15.97	17.74	19.52	21.29	23.06	24.84	26.61	28.39	30.16	31.94	33.71	35.48	37.26	39.03	40.81	11
12	15.48	17.42	19.35	21.29	23.23	25.16	27.10	29.03	30.97	32.90	34.84	36.77	38.71	40.65	42.58	44.52	12
13	16.77	18.87	20.97	23.06	25.16	27.26	29.35	31.45	33.55	35.65	37.74	39.84	41.94	44.03	46.13	48.23	13
14	18.06	20.32	22.58	24.84	27.10	29.35	31.61	33.87	36.13	38.39	40.65	42.90	45.16	47.42	49.68	51.94	14
15	19.35	21.77	24.19	26.61	29.03	31.45	33.87	36.29	38.71	41.13	43.55	45.97	48.39	50.81	53.23	55.65	15
16	20.65	23.23	25.81	28.39	30.97	33.55	36.13	38.71	41.29	43.87	46.45	49.03	51.61	54.19	56.77	59.35	16
17	21.94	24.68	27.42	30.16	32.90	35.65	38.39	41.13	43.87	46.61	49.35	52.10	54.84	57.58	60.32	63.06	17
18	23.23	26.13	29.03	31.94	34.84	37.74	40.65	43.55	46.45	49.35	52.26	55.16	58.06	60.97	63.87	66.77	18
19	24.52	27.58	30.65	33.71	36.77	39.84	42.90	45.97	49.03	52.10	55.16	58.23	61.29	64.35	67.42	70.48	19
20	25.81	29.03	32.26	35.48	38.71	41.94	45.16	48.39	51.61	54.84	58.06	61.29	64.52	67.74	70.97	74.19	20
21	27.10	30.48	33.87	37.26	40.65	44.03	47.42	50.81	54.19	57.58	60.97	64.35	67.74	71.13	74.52	77.90	21
22	28.39	31.94	35.48	39.03	42.58	46.13	49.68	53.23	56.77	60.32	63.87	67.42	70.97	74.52	78.06	81.61	22
23	29.68	33.39	37.10	40.81	44.52	48.23	51.94	55.65	59.35	63.06	66.77	70.48	74.19	77.90	81.61	85.32	23
24	30.97	34.84	38.71	42.58	46.45	50.32	54.19	58.06	61.94	65.81	69.68	73.55	77.42	81.29	85.16	89.03	24
25	32.26	36.29	40.32	44.35	48.39	52.42	56.45	60.48	64.52	68.55	72.58	76.61	80.65	84.68	88.71	92.74	25
26	33.55	37.74	41.94	46.13	50.32	54.52	58.71	62.90	67.10	71.29	75.48	79.68	83.87	88.06	92.26	96.45	26
27	34.84	39.19	43.55	47.90	52.26	56.61	60.97	65.32	69.68	74.03	78.39	82.74	87.10	91.45	95.81	100.16	27
28	36.13	40.65	45.16	49.68	54.19	58.71	63.23	67.74	72.26	76.77	81.29	85.81	90.32	94.84	99.35	103.87	28
29	37.42	42.10	46.77	51.45	56.13	60.81	65.48	70.16	74.84	79.52	84.19	88.87	93.55	98.23	102.90	107.58	29
30	38.71	43.55	48.39	53.23	58.06	62.90	67.74	72.58	77.42	82.26	87.10	91.94	96.77	101.61	106.45	111.29	30
31	40.00	45.00	50.00	55.00	60.00	65.00	70.00	75.00	80.00	85.00	90.00	95.00	100.00	105.00	110.00	115.00	31

31 DAY MONTH 31
TABLE OF AMOUNTS EARNED AT VARIOUS MONTHLY RATES

Days	Amount Earned at Different Rates															Days
	120.00	125.00	130.00	135.00	140.00	145.00	150.00	155.00	160.00	165.00	170.00	175.00	180.00	185.00	190.00	
1	3.87	4.03	4.19	4.35	4.52	4.68	4.84	5.00	5.16	5.32	5.48	5.65	5.81	5.97	6.13	1
2	7.74	8.06	8.39	8.71	9.03	9.35	9.68	10.00	10.32	10.65	10.97	11.29	11.61	11.94	12.26	2
3	11.61	12.10	12.58	13.06	13.55	14.03	14.52	15.00	15.48	15.97	16.45	16.94	17.42	17.90	18.39	3
4	15.48	16.13	16.77	17.42	18.06	18.71	19.35	20.00	20.65	21.29	21.94	22.58	23.23	23.87	24.52	4
5	19.35	20.16	20.97	21.77	22.58	23.39	24.19	25.00	25.81	26.61	27.42	28.23	29.03	29.84	30.65	5
6	23.23	24.19	25.16	26.13	27.10	28.06	29.03	30.00	30.97	31.94	32.90	33.87	34.84	35.81	36.77	6
7	27.10	28.23	29.35	30.48	31.61	32.74	33.87	35.00	36.13	37.26	38.39	39.52	40.65	41.77	42.90	7
8	30.97	32.26	33.55	34.84	36.13	37.42	38.71	40.00	41.29	42.58	43.87	45.16	46.45	47.74	49.03	8
9	34.84	36.29	37.74	39.19	40.65	42.10	43.55	45.00	46.45	47.90	49.35	50.81	52.26	53.71	55.16	9
10	38.71	40.32	41.94	43.55	45.16	46.77	48.39	50.00	51.61	53.23	54.84	56.45	58.06	59.68	61.29	10
11	42.58	44.35	46.13	47.90	49.68	51.45	53.23	55.00	56.77	58.55	60.32	62.10	63.87	65.65	67.42	11
12	46.45	48.39	50.32	52.26	54.19	56.13	58.06	60.00	61.94	63.87	65.81	67.74	69.68	71.61	73.55	12
13	50.32	52.42	54.52	56.61	58.71	60.81	62.90	65.00	67.10	69.19	71.29	73.39	75.48	77.58	79.68	13
14	54.19	56.45	58.71	60.97	63.23	65.48	67.74	70.00	72.26	74.52	76.77	79.03	81.29	83.55	85.81	14
15	58.06	60.48	62.90	65.32	67.74	70.16	72.58	75.00	77.42	79.84	82.26	84.68	87.10	89.52	91.94	15
16	61.94	64.52	67.10	69.68	72.26	74.84	77.42	80.00	82.58	85.16	87.74	90.32	92.90	95.48	98.06	16
17	65.81	68.55	71.29	74.03	76.77	79.52	82.26	85.00	87.74	90.48	93.23	95.97	98.71	101.45	104.19	17
18	69.68	72.58	75.48	78.39	81.29	84.19	87.10	90.00	92.90	95.81	98.71	101.61	104.52	107.42	110.32	18
19	73.55	76.61	79.68	82.74	85.81	88.87	91.94	95.00	98.06	101.13	104.19	107.26	110.32	113.39	116.45	19
20	77.42	80.65	83.87	87.10	90.32	93.55	96.77	100.00	103.23	106.45	109.68	112.90	116.13	119.35	122.58	20
21	81.29	84.68	88.06	91.45	94.84	98.23	101.61	105.00	108.39	111.77	115.16	118.55	121.94	125.32	128.71	21
22	85.16	88.71	92.26	95.81	99.35	102.90	106.45	110.00	113.55	117.10	120.65	124.19	127.74	131.29	134.84	22
23	89.03	92.74	96.45	100.16	103.87	107.58	111.29	115.00	118.71	122.42	126.13	129.84	133.55	137.26	140.97	23
24	92.90	96.77	100.65	104.52	108.39	112.26	116.13	120.00	123.87	127.74	131.61	135.48	139.35	143.23	147.10	24
25	96.77	100.81	104.84	108.87	112.90	116.94	120.97	125.00	129.03	133.06	137.10	141.13	145.16	149.19	153.23	25
26	100.65	104.84	109.03	113.23	117.42	121.61	125.81	130.00	134.19	138.39	142.58	146.77	150.97	155.16	159.35	26
27	104.52	108.87	113.23	117.58	121.94	126.29	130.65	135.00	139.35	143.71	148.06	152.42	156.77	161.13	165.48	27
28	108.39	112.90	117.42	121.94	126.45	130.97	135.48	140.00	144.52	149.03	153.55	158.06	162.58	167.10	171.61	28
29	112.26	116.94	121.61	126.29	130.97	135.65	140.32	145.00	149.68	154.35	159.03	163.71	168.39	173.06	177.74	29
30	116.13	120.97	125.81	130.65	135.48	140.32	145.16	150.00	154.84	159.68	164.52	169.35	174.19	179.03	183.87	30
31	120.00	125.00	130.00	135.00	140.00	145.00	150.00	155.00	160.00	165.00	170.00	175.00	180.00	185.00	190.00	31

31 DAY MONTH 31
TABLE OF AMOUNTS EARNED AT VARIOUS MONTHLY RATES

Days	Amount Earned at Different Rates															Days
	195.00	200.00	205.00	210.00	215.00	220.00	225.00	230.00	235.00	240.00	245.00	250.00	255.00	300.00	325.00	
1	6.29	6.45	6.61	6.77	6.94	7.10	7.26	7.42	7.58	7.74	7.90	8.06	8.27	9.68	10.48	1
2	12.58	12.90	13.23	13.55	13.87	14.19	14.52	14.84	15.16	15.48	15.81	16.13	17.74	19.35	20.97	2
3	18.87	19.35	19.84	20.32	20.81	21.29	21.77	22.26	22.74	23.23	23.71	24.19	26.61	29.03	31.45	3
4	25.16	25.81	26.45	27.10	27.74	28.39	29.03	29.68	30.32	30.97	31.61	32.26	35.48	38.71	41.94	4
5	31.45	32.26	33.06	33.87	34.68	35.48	36.29	37.10	37.90	38.71	39.52	40.32	44.35	48.39	52.42	5
6	37.74	38.71	39.68	40.65	41.61	42.58	43.55	44.52	45.48	46.45	47.42	48.39	53.23	58.06	62.90	6
7	44.03	45.16	46.29	47.42	48.55	49.68	50.81	51.94	53.06	54.19	55.32	56.45	62.10	67.74	73.39	7
8	50.32	51.61	52.90	54.19	55.48	56.77	58.06	59.35	60.65	61.94	63.23	64.52	70.97	77.42	83.87	8
9	56.61	58.06	59.52	60.97	62.42	63.87	65.32	66.77	68.23	69.68	71.13	72.58	79.84	87.10	94.35	9
10	62.90	64.52	66.13	67.74	69.35	70.97	72.58	74.19	75.81	77.42	79.03	80.65	88.71	96.77	104.84	10
11	69.19	70.97	72.74	74.52	76.29	78.06	79.84	81.61	83.39	85.16	86.94	88.71	97.58	106.45	115.32	11
12	75.48	77.42	79.35	81.29	83.23	85.16	87.10	89.03	90.97	92.90	94.84	96.77	106.45	116.13	125.81	12
13	81.77	83.87	85.97	88.06	90.16	92.26	94.35	96.45	98.55	100.65	102.74	104.84	115.32	125.81	136.29	13
14	88.06	90.32	92.58	94.84	97.10	99.35	101.61	103.87	106.13	108.39	110.65	112.90	124.19	135.48	146.77	14
15	94.35	96.77	99.19	101.61	104.03	106.45	108.87	111.29	113.71	116.13	118.55	120.97	133.06	145.16	157.26	15
16	100.65	103.23	105.81	108.39	110.97	113.55	116.13	118.71	121.29	123.87	126.45	129.03	141.94	154.84	167.74	16
17	106.94	109.68	112.42	115.16	117.90	120.65	123.39	126.13	128.87	131.61	134.35	137.10	150.81	164.52	178.23	17
18	113.23	116.13	119.03	121.94	124.84	127.74	130.65	133.55	136.45	139.35	142.26	145.16	159.68	174.19	188.71	18
19	119.52	122.58	125.65	128.71	131.77	134.84	137.90	140.97	144.03	147.10	150.16	153.23	168.55	183.87	199.19	19
20	125.81	129.03	132.26	135.48	138.71	141.94	145.16	148.39	151.61	154.84	158.06	161.29	177.42	193.55	209.68	20
21	132.10	135.48	138.87	142.26	145.65	149.03	152.42	155.81	159.19	162.58	165.97	169.35	186.29	203.23	220.16	21
22	138.39	141.94	145.48	149.03	152.58	156.13	159.68	163.23	166.77	170.32	173.87	177.42	195.16	212.90	230.65	22
23	144.68	148.39	152.10	155.81	159.52	163.23	166.94	170.65	174.35	178.06	181.77	185.48	204.03	222.58	241.13	23
24	150.97	154.84	158.71	162.58	166.45	170.32	174.19	178.06	181.94	185.81	189.68	193.55	212.90	232.26	251.61	24
25	157.26	161.29	165.32	169.35	173.39	177.42	181.45	185.48	189.52	193.55	197.58	201.61	221.77	241.94	262.10	25
26	163.55	167.74	171.94	176.13	180.32	184.52	188.71	192.90	197.10	201.29	205.48	209.68	230.65	251.61	272.58	26
27	169.84	174.19	178.55	182.90	187.26	191.61	195.97	200.32	204.68	209.03	213.39	217.74	239.52	261.29	283.06	27
28	176.13	180.65	185.16	189.68	194.19	198.71	203.23	207.74	212.26	216.77	221.29	225.81	248.39	270.97	293.55	28
29	182.42	187.10	191.77	196.45	201.13	205.81	210.48	215.16	219.84	224.52	229.19	233.87	257.26	280.65	304.03	29
30	188.71	193.55	198.39	203.23	208.06	212.90	217.74	222.58	227.42	232.26	237.10	241.94	266.13	290.32	314.52	30
31	195.00	200.00	205.00	210.00	215.00	220.00	225.00	230.00	235.00	240.00	245.00	250.00	255.00	300.00	325.00	31

[119]

MEMORANDA

INDEX

i

	Paragraph
Accidents	1.37
Account Code and Classification.....	Chapter III
Accounts and Codes	2.8
Addresses	1.12
Assistant Bituminous Engineer.....	1.6
Assistant Maintenance Engineer.....	1.4
Beautification	6.1
Betterments	2.11-2.15
Blasting	6.2
Boilers and Retorts	4.36
Borrowing Equipment	4.11
Bridge Approaches	5.9
Bridges	6.3
Buildings and Camps	6.4
Centerline Painting	6.17
Claims, Gas and Oil.....	2.25
Claims, General	2.24
Code Numbers	2.14
Code Suffixes	2.16
Coding Claims	2.20
Construction of Special Maintenance Units.....	1.27
Correspondence	1.19
Cross Roads	5.4
Crushed Gravel and Rock Surfaces.....	5.13
Crushers	4.35
Culverts	6.5
Cutting Timber	1.35
Detail of Work and Estimates.....	2.4
Detours	6.6
Disposal of Equipment	4.15
District Mechanic	4.8
District Shops	4.3
Division Engineers	1.7
Division Mechanic	4.7

	Paragraph
Division Offices	1.2
Division Shops	4.2
Drainage	5.3-6.7
Earth Roads	5.12
Emergencies	1.36
Emergency Purchases	2.23
Employment	1.10
Equipment—	
Accident	1.37
Borrowing	4.11
Clerk	4.6
Department	Chapter IV
Disposal	4.15
General Operating Instructions	4.28
New Equipment for Trial	4.14
Manufacturers' Instructions and Recommendations	4.25
Operating Personnel	4.29
Operation of Cars	4.30
Painting	4.23
Rental Schedule	4.13
Recommended SAE Weights of Oil.....	4.21
Recommended Tire Pressure	4.22
Responsibility and Protection	4.9
Salvage of Parts	4.26
Servicing—New and Used	4.20
Shop Practice	4.24
Shop Tools	4.27
Stock of Supplies	4.10
Superintendent	1.5-4.4
Truck Operation	4.31
Fences—Right of Way	6.8
Fences—Snow	6.8
Financial Control	2.2
Foremen and Sectionmen	1.9

INDEX

iii

	Paragraph
Forms (Standard)	6.26
Fountains	6.13
Freight and Express	1.21
Frost Boils	6.9
Funds and Accounting	Chapter II
Gasoline and Plant Set Up.....	1.32
General Maintenance	2.9
General Operating Instruction	4.28
Grader Operation	4.32
Guard Rail	6.10
Headquarters, Equipment Dept.	4.1
Headquarters Office	1.1
Laws	1.17
Load Limits	1.34
M 20 Holding Account	2.18
Mail Boxes	6.11
Maintaining of Bldgs., Yards, Tools and Tool Equipment	4.19
Maintenance Coding	2.17
Maintenance Engineer	1.3
Maintenance—General	2.9
Maintenance—Special	2.10
Manufacturers' Instructions and Recommenda- tions	4.25
Master Mechanic	4.5
Methods Surface Maintenance	5.1
Miscellaneous Coding	2.19
Miscellaneous Maintenance	Chapter VI
Miscellaneous Reports, etc.	1.28
Monthly Statements	2.6
New Equipment for Trial	4.14
New Road Approaches	6.12

	Paragraph
Oiled Surfaces	5.14
Oiled Stock Piles	5.15
Operation of Cars	4.30
Operating Personnel	4.29
Order Numbers	2.13
Organization and General Details.....	Chapter I
Overdrafts	2.7
Oversize	5.7
Painting	4.23-6.17
Parts (Salvage)	4.26
Pavements	5.16
Payroll	1.18
Permits for Excess Size and Weight.....	1.33
Personal Liability	1.37
Personnel Cards	1.11
Personnel Employment	1.10
Personnel Operation of Equipment	4.29
Personnel Responsibility	1.15
Personnel Responsibility for Equipment.....	4.9
Personnel, Qualifications of Shop Employees.....	4.16
Plows—Snow	4.34
Procedure on Work Orders	2.5
Protecting Equipment and Men	5.11
Purchase of Gas, Oil and Grease.....	2.22
Purchases—General	2.21
Railroad Crossings	5.10
Rental of Equipment	4.12
Rental Schedule	4.13
Reports	1.22-1.26-1.28-6.26-6.27
Requisitions	1.24-6.27
Resident Engineers and Maintenance Superintendents	1.8
Responsibility	1.15
Responsibility and Protection—Equipment.....	4.9
Retaining Walls	6.23

INDEX

v

	Paragraph
Retorts	4.36
Roadside Fountains	6.13
Road Approaches	6.12
Rock Surfaces	5.13
Rubbish	6.14
Safety Instructions for Operators	4.37
Sale of Materials	1.25
Salvage of Parts	4.26
Sanding of Icy Surfaces and Snow Removal.....	5.2
Sectionmen's Weekly Reports	1.22
Section Prefixes	2.12
Service Stations	6.15
Schedule of Reports and Requisitions, General....	6.27
Shop Instructions	4.16-4.17-4.18-4.19-4.20-4.21-4.22 4.23-4.24-4.25-4.26-4.27
Shop Practice	4.24
Shop Tools	4.27
Shoulders	5.6
Sight Clearing	6.16
Signs	6.18
Slides and Washouts	5.5
Small Tools and Supplies	1.26
Snow—	
Fences	6.8
Removal	5.2
Plows	4.34
Sources of Funds	2.1
Special Maintenance	2.10
Standard Forms	6.26
State Equipment Accidents	1.37
State Property for Private Use.....	4.18
Stock of Supplies, Equipment	4.10
Stock Piles	6.19
Submission of Claims	2.26
Surface Maintenance	Chapter V
Surface Types and Their Maintenance....	5.12-5.13-5.14

	Paragraph
Telephone and Telegraph	1.20
Tire Pressure	4.22
Tools, Shop	4.27
Tractor Operation	4.33
Tractors	6.20
Traffic Counts	6.21
Transfer and Repair of Special Equipment (Gas, Shovels, Crushers, etc.)	1.29
Transfer and Repair of Major Equipment (Motor Patrols, Cats, etc.)	1.30
Transfer of Personnel	1.16
Transporting Personal Cars, Bunk Houses, etc....	1.31
Traveling Expenses	1.23
Truck Operation	4.31
Wage Scale	1.13
Walls, Retaining	6.23
Warning Posts	6.22
Waste Water	6.24
Weeds	6.25
Windrowing Material	5.8
Work Orders	2.3
Working Hours	1.14-4.17



